THE Journal

APRIL

1955

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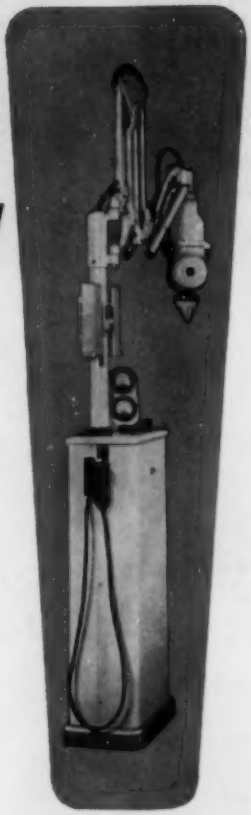

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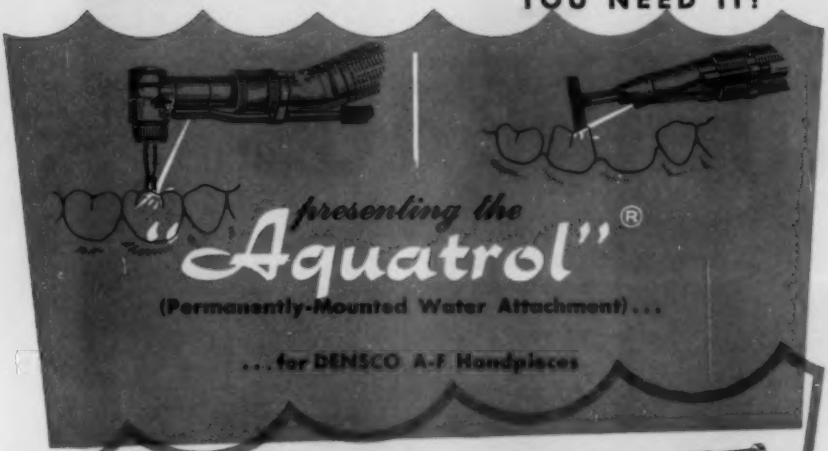

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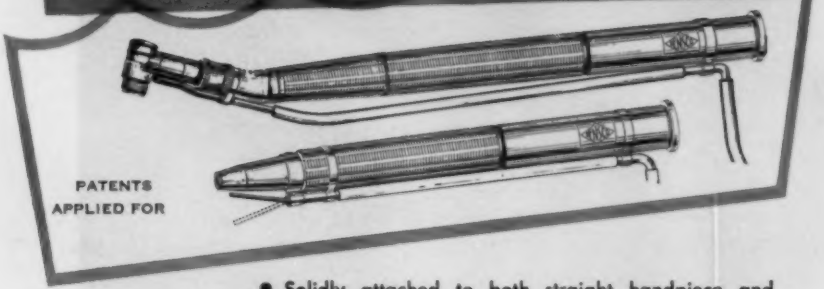

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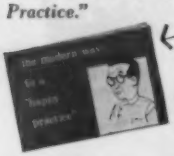

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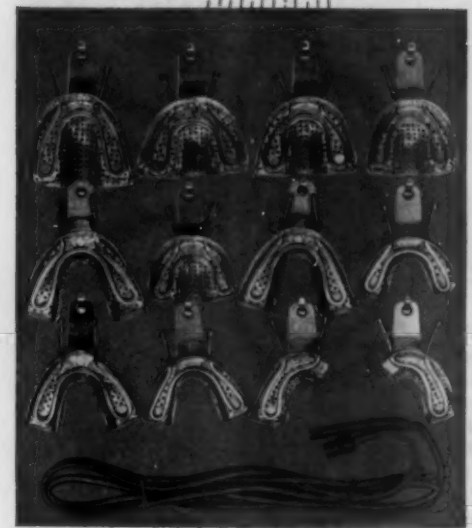

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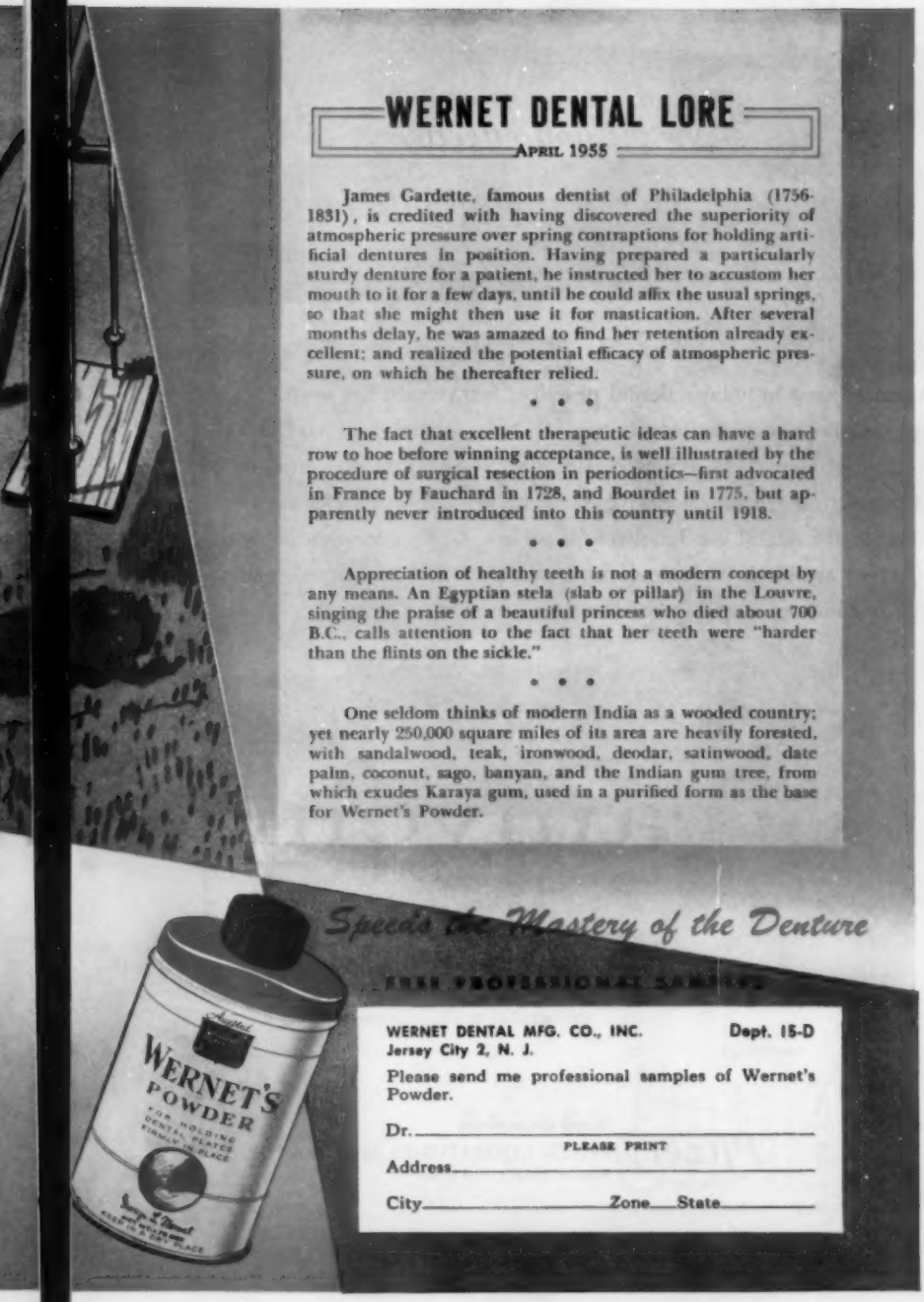

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• • •

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• • •

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1. Winter, L., Jr., and Van Gasbeek, B.: New York State Dent. J. 18:119 (March) 1952.
2. Pollock, S. L., and Archer, W. H.: Pennsylvania Dent. J. 20:10 (March) 1953.
3. Kurzrock, A. H.: J. New Jersey Dent. Soc. 24:49 (April) 1953.

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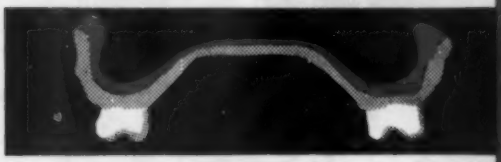

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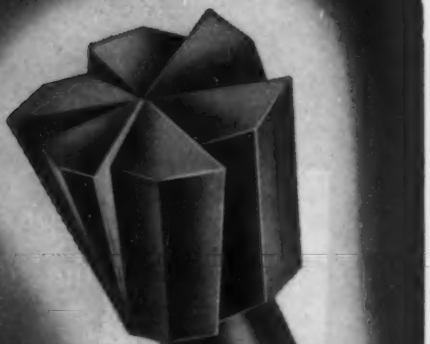

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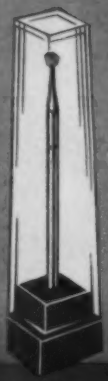

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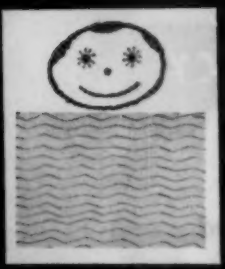

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VOLUME 50 • NUMBER 4

Factors influencing the cutting characteristics of rotating dental instruments

Donald C. Hudson, D.D.S.; Jack L. Hartley,† D.D.S.; Robert Moore,‡ B.S., and William T. Sweeney,§ A.B., Washington, D. C.*

The Dental Research Laboratory of the National Bureau of Standards has been conducting research on methods of evaluating rotating dental cutting instruments for some time. Since 1950, when the U. S. Air Force began active support of the research program, the following characteristics of conventional dental burs and abrasive instruments have been examined: (1) temperatures developed in rotating dental burs; (2) vibration produced by dental burs and diamond abrasive instruments and (3) the behavior of the instruments as they cut tooth structures.

The purpose of these studies has been twofold. Primary interest has focused on obtaining the most efficient operation of rotary cutting instruments consistent with producing minimum trauma on vital structures from temperature rise and vibration. Secondly, it has been hoped that information obtained from these studies might be used in formulating specifications for burs and abrasive instruments for the armed services.

Peyton, Vaughn and Henry[1-3] have conducted investigations at the University of Michigan on the relation between temperature rise and cutting rates of dental burs and their rotational speeds. A study conducted at the National Bu-

Presented as part of a panel discussion "Newer Devices for Cutting Tooth Structure" before the Sections on Operative Dentistry and Research, ninety-fifth annual session, American Dental Association, Miami, Fla., November 9, 1954.

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†Major, Dental Service, U.S. Air Force. Guest worker, Dental Research Section, National Bureau of Standards.

‡Private, U.S. Army. Guest worker, Dental Research Section, National Bureau of Standards.

§Chief, Dental Research Section, National Bureau of Standards.

1. Vaughn, R. C., and Peyton, F. A. Influence of rotational speed on temperature rise during cavity preparation. J. D. Res. 30:737 Oct. 1951.

2. Peyton, F. A. Temperature rise and cutting efficiency of rotating instruments. New York D. J. 18:439 Nov. 1952.

3. Henry, E. E., and Peyton, F. A. Vibration characteristics of the rotating dental instrument. J. D. Res. 29:601 Oct. 1950.

reau of Standards also dealt with temperatures developed in rotating dental burs.[4] This study revealed that temperatures which range from 140° F. to 600° F. may be reached at the site of operation, depending on the speed of rotation, the operating pressure and the material being cut. Such temperatures would contribute to the discomfort caused by dental operative procedures and would damage vital tissues. The study indicated that coolants should be employed in clinical practice, even when instruments are operating at low rotational speeds.

Vibration caused by rotating instruments possibly is not as damaging to vital structures as heat; nevertheless, it annoys the patient and contributes to his dislike of dental operations. A chattering instrument cannot be controlled by the operator in detailed cavity preparation.

Walsh and Symmons,[5] in a study of vibration and its effect on dental patients, found that vibration applied to teeth produces the most unfavorable response when its frequency is between 100 cycles per second (cps) and 200 cps (Fig. 1, left). Frequencies above 1,000 cps are generally beyond the upper threshold of perception of the average patient (Fig. 1, right[5]). The lower frequencies in the range 100 to 200 cps unfortunately are dominant in eccentric burs rotated at 6,000 to 10,000 rpm, speeds now used by many practitioners.

EXPERIMENTAL PROCEDURE

The experimental apparatus used in our studies of the vibration produced in rotating instruments consisted of the following: (1) a hard steel vane supported so that it rested against the periphery of the bur or abrasive wheel being studied and (2) an electronic micrometer of the mutual inductance type energized by the 4.8 megacycle output of a low powered RF generator. The pickup, which was held close to the steel vane, reacted to minute movements of the vane as it was caused to shift in a plane normal to the

4. Hudson, D. C., and Sweeney, W. T. Temperatures developed in rotating dental cutting instruments. J.A.D.A. 48:127 Feb. 1954.

5. Walsh, J. P., and Symmons, H. F. Vibration perception and frequencies. New Zealand D. J. 45:106 April 1949.

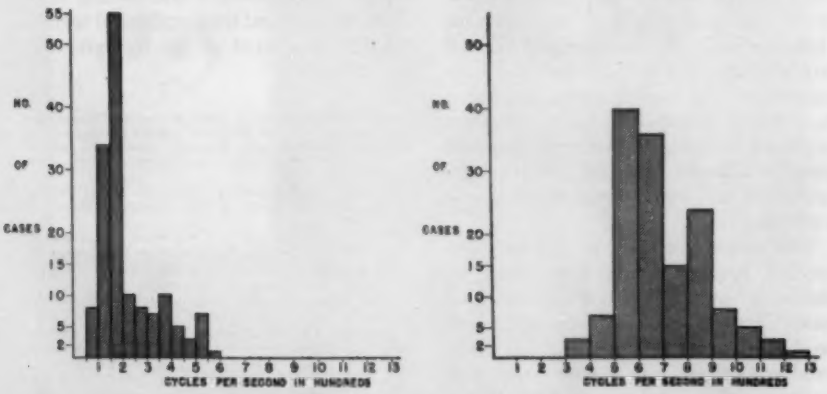

Fig. 1 • Left: Frequency that caused maximum unpleasantness, in cps. Frequencies of 50 cps to 1,300 cps were applied to all patients. Right: Upper threshold of perception of vibration

long axis of the pickup from irregularities in the rotating instrument (Fig. 2).

Instruments were rotated in a precision chuck of the draw collet type, whose eccentricity was negligible; thus, any displacement of the steel vane was caused by instrument eccentricity or surface irregularity. Output of the vibration pickup was applied to the Y-axis deflection plates of an oscilloscope on whose screen the wave forms were studied or photographed.

Observation of the pattern of vibrations produced by dental burs and abrasive wheels, with no consideration of the effects of looseness or irregularity of the handpiece, revealed that the principal cause of vibration was bur eccentricity. The amplitude of this vibration was directly proportional to the degree of eccentricity (Fig. 3, above and below).

A photograph of the oscilloscope trace produced by a true-running eight-bladed bur, rotating at 10,000 rpm, shows eight low-amplitude peaks per revolution at a frequency of 1,330 cps (Fig. 4, above). A similar bur, if eccentric and rotating at the same speed, produces a fundamental frequency of 166 cps, with amplitude proportional to the amount of eccentricity. The 1,330 cps wave is still seen, modulating the lower frequency, but at an amplitude that is low in comparison to that of the fundamental (Fig. 4, below).

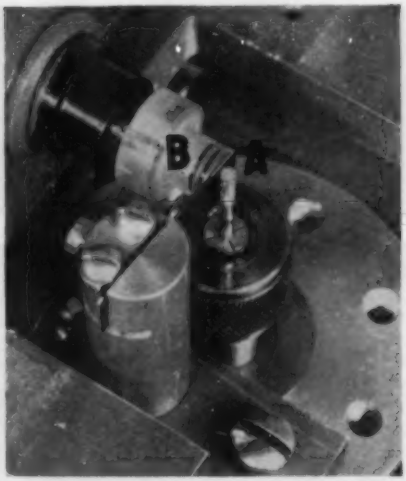

Fig. 2 • Apparatus for vibration studies. A, steel vane, bearing against periphery of rotating instrument. B, electronic micrometer pickup. Note general arrangement of precision chuck, with rotating instrument, steel vane and micrometer pickup in position to record vibration

DISCUSSION

A true-running bur at 10,000 rpm produces vibration in a frequency range well above that which produces unpleasant reaction in the patient,[5] whereas the eccentric bur produces vibration in the range of frequencies which cause maximum unpleasantness. Application to clinical practice of the information obtained in this study must await improvements in the manufacture of rotating instruments. Closer tolerances in fabrication and more symmetrical shaping of the cutting heads of burs and wheels should remove, to a great degree, the cause of annoying chatter and vibration in the range of frequencies most distressing to the patient.

The effects of poor performance of the handpiece, however, cannot be ignored. A true-running instrument will not perform properly in a handpiece that does not operate smoothly. To date, our studies at the National Bureau of Standards have not included dental handpieces. Such studies will be undertaken in the near future.

METAL BURS AND DIAMOND INSTRUMENTS

Data on relative cutting abilities of steel and carbide burs in a synthetic substitute for dentin were obtained in earlier experiments.[4] Preliminary results of our

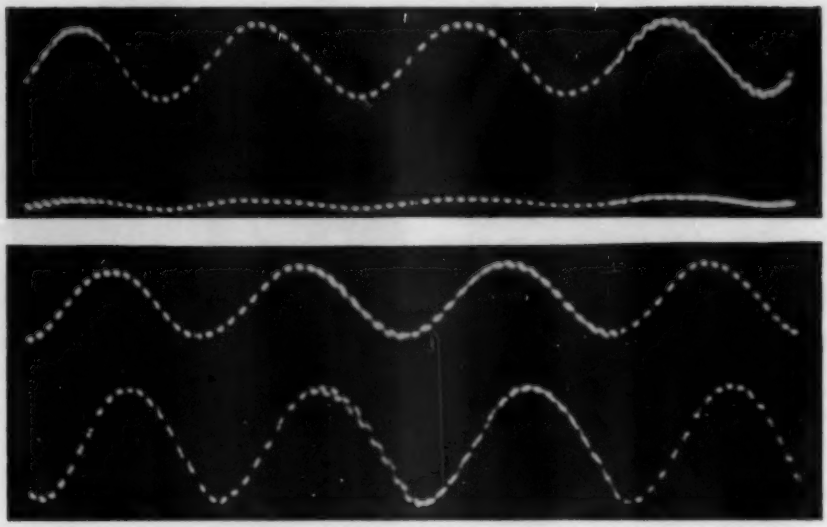

Fig. 3 • Above: Upper trace, wave form produced by standard frequency oscillator at 166 cps. Lower trace, wave form produced by diamond instrument .001" eccentric, rotating at 10,000 rpm. Note low amplitude of 166 cps vibration frequency produced at this speed. Below: Upper trace, wave form produced by standard audio frequency oscillator at 166 cps. Lower trace, wave form produced by diamond instrument .007" eccentric, rotating at 10,000 rpm. Note increased amplitude of 166 cps vibration frequency produced at this speed

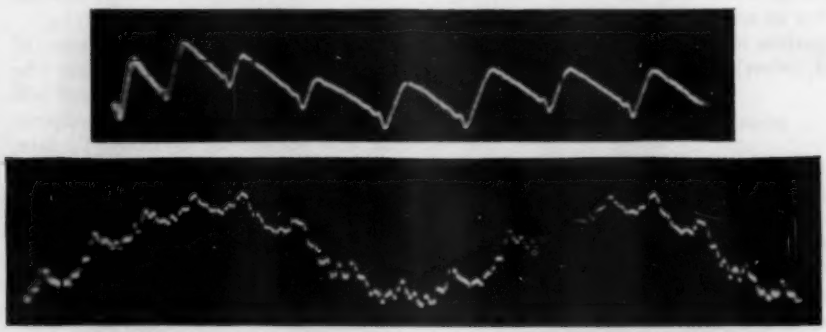

Fig. 4 • Above: Trace produced by eight-bladed instrument .001" eccentric, rotating at 10,000 rpm. Frequency of vibration produced is about 1,300 cps. Low-frequency component is of very low amplitude. Below: Trace produced by eight-bladed instrument .007" eccentric, rotating at 10,000 rpm. Low-frequency component (166 cps) is of considerable amplitude. High-frequency component (1,300 cps) is of lower amplitude

Table 1 • Cutting rate in human enamel of six-bladed no. 559 steel burs at 200 Gm. load

Sample	Mfgr.	Cutting rate in mg. per min.	Cutting efficiency in mg. per 100 surface feet
		Speed 5,000 rpm*	
1	A	1.06	1.36
2	A	0.82	1.05
3	A	0.66	0.85
4	C	1.22	1.56
5	C	1.64	2.10
6	C	1.54	1.98
		Speed 10,000 rpm†	
7	A	0.74	0.48
8	A	0.96	0.61
9	A	0.48	0.31
10	C	1.04	0.66
11	C	0.76	0.49
12	C	0.62	0.40

*Seventy-eight surface feet per minute. All instruments cut for 5 minutes in specimens from tooth no. 1.

†One hundred and fifty-six surface feet per minute. All instruments cut for 5 minutes in specimens from tooth no. 3.

Table 2 • Cutting rate in human enamel of no. 559 carbide burs at 200 Gm. load

Sample	Mfgr.	No. blades	Cutting rate in mg. per min.	Cutting efficiency in mg. per 100 surface feet
			Speed 5,000 rpm*	
1	A	6	1.17	1.50
2	A	6	0.82	1.05
3	A	6	1.63	2.09
4	B	8	0.72	0.92
5	B	8	1.04	1.33
6†	B	8	4.19	5.37
			Speed 10,000 rpm‡	
7	A	6	1.20	0.77
8	A	6	1.34	0.86
9	A	6	1.63	1.04
10	B	8	1.34	0.86
11	B	8	1.25	0.80
12	B	8	2.11	1.35

*Seventy-eight surface feet per minute. All burs cut for 10 minutes in specimens from tooth no. 1.

†Bur blade fractured; resulting eccentric instrument cut at higher rate but produced severe vibration.

‡One hundred and fifty-six surface feet per minute. All burs cut 10 minutes in specimens from tooth no. 3.

more recent work revealed that the burs behave similarly in human dentin. There was little difference in the cutting rates of steel and carbide burs. They both cut faster as their speeds of rotation increased.

Table 3 • Cutting rates of approximately ¼ in. diameter diamond abrasive wheels in human enamel at 200 Gm. load

Sample	Mfgr.	Cutting rate in mg. per min.	Cutting efficiency in mg. per 100 surface feet
		Speed 5,000 rpm*	
1	A	125.7	27.94
2	A	125.7	27.93
3	A	130.9	29.09
4	A	155.1	34.46
5	A	116.1	25.80
6	B	119.2	26.49
7	B	138.4	30.75
8	B	113.9	25.31
9	B	115.3	25.62
10	B	104.8	23.29
		Speed 10,000 rpm*	
11	A	214.9	23.87
12	A	179.7	19.96
13	A	244.6	27.18
14	A	280.3	31.14
15	A	202.1	22.45
16	B	262.6	29.18
17	B	323.3	35.92
18	B	234.3	26.03
19	B	225.9	25.10
20	B	321.8	35.75

*Surface speed adjusted according to diameter of instrument to 450 and 900 surface feet per minute, respectively, corresponding to approximately 5,000 and 10,000 rpm. Total cutting time per instrument was 10 minutes.

Further results of these more recent studies of steel and carbide burs when cutting human tooth enamel are shown in Tables 1 and 2. The data indicate little difference in the amount of enamel cut between steel burs from two manufacturers (Table 1). The burs, which rotated at 5,000 rpm, cut specimens taken from a single molar tooth. Two manufacturers' carbide burs, which cut specimens

from the same tooth under the same conditions, showed little difference in cutting rate (Table 2).

When the speed of rotation was 10,000 rpm and specimens from another molar tooth were cut, little difference in rate of cut was noted between two makes of steel burs (Table 1). Carbide burs from two manufacturers also cut at about the same rate at this speed (Table 2).

When used on enamel at 5,000 rpm, carbide burs and steel burs cut at substantially the same rate. At 10,000 rpm, however, carbide burs cut twice as fast as steel burs in the same tooth specimen.

No effort has been made to account for these differences between the cutting rates of carbide and steel burs.

The enamel from one tooth was consumed during the evaluations at 5,000 rpm. Another tooth was required for obtaining data at 10,000 rpm. Since a possible variation in hardness of enamel between the two teeth used must be considered, no valid comparison of the cutting efficiencies of these burs at the two speeds can be made.

The enamel from approximately 200 teeth was removed while the data was being obtained for the study on diamond abrasive instruments. These instruments removed 25 to 30 or more mg. of enamel per 100 surface feet of operation (Table 3). Burs of steel and carbide removed approximately 0.5 to 2.0 mg. of enamel per 100 surface feet (Table 2). The cutting efficiency of the diamond instruments tested did not increase as the speed of rotation was raised from 5,000 rpm to 10,000 rpm. Cutting rates, however, were approximately doubled at the higher speed.

SUMMARY

Vibration in a frequency range most distressing to patients is produced by eccentricity in rotating dental instruments.

High speed rotation of dental instruments (10,000 rpm) is advantageous, in that vibration produced by bur blades is raised in frequency to a point above the range of frequency which causes maximum unpleasantness as defined by Walsh and Symmons. In addition, diamond instruments cut more rapidly at this higher speed. The cutting rates of both steel and carbide burs are improved at the higher speed when cutting dentin.

Carbide burs cut at twice the rate of steel burs at the rotational speed of 10,000 rpm. Diamond abrasive instruments are many times more efficient than either steel or carbide burs when cutting tooth enamel.

Mark of Greatness • Greatness has always been a mark to aim at. In these rudderless days, when we are misguided by small and fumbling minds, it is not only inspiring but imperative to "think continually of those who were truly great." Soldiers on forgotten fields of battle, scientists in makeshift laboratories, stubborn idealists fighting to save a lost cause, teachers who would not be intimidated, tireless doctors, the anonymous army of dreamers and doers—all these by their very living fought for everyone. They sacrificed hours of ease for our casual comforts; they gave up safety for our security. Glorifying the heroic spirit of man, they added to our stature. *Louis Untermeyer.*

Evaluation of dental handpieces for high speed operations

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During the past 70 or 75 years there has been little significant change in the basic design of the dental handpiece for rotating instruments, because the original design of this instrument was generally satisfactory. During this same period, however, numerous refinements have been made in the basic instrument which have permitted greater flexibility and better functioning of the instrument during the cutting of tooth tissue. Most of these developments were associated with the contemporary advances that have occurred in the field of machine tool manufacture and the general production of precision instruments.

One of the most recent refinements in dental handpieces is the development of instruments which are capable of being operated at increased speeds of rotation. The speed of rotation, of course, is relative. Speeds which were previously considered slow, medium and high now are considered to be in the slower ranges of rotation. The present optimum and maximum speeds of rotation likewise may change within a few years because of further refinements and changes in instrument design.

At the present time there is little agreement among either the manufacturers of dental engines and handpieces or dentists who use the handpiece, regarding the possible optimum and maximum speeds of rotation. It is agreed, however, that faster speeds of instrument rotation are now practical and possible when compared to instruments available ten years ago. For example, until recently, manufacturers of engines and handpieces made available instruments that operated within the accepted range of 4,000 to 6,000 rpm. Standard equipment is now obtainable which operates at speeds from 10,000 to 20,000 rpm, and experimental studies are being conducted with instruments operating at speeds of 30,000 to 75,000 rpm.

The clinical or laboratory justification for speeds over 15,000 to 20,000 rpm has not been fully established. Many problems of production and manufacture of a well balanced instrument with a potential long life when operated at excessive speeds have not been solved. The care and maintenance of both the handpieces and motor units when operated at speeds of more than 15,000 rpm continue to be a problem of importance.

Presented as part of a panel discussion "Newer Devices for Cutting Tooth Structure" before the Sections on Operative Dentistry and Research, ninety-fifth annual session, American Dental Association, Miami, Fla., November 9, 1954.

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Since the introduction and general acceptance of carbide burs and diamond cutting instruments to supplement steel burs and carborundum instruments, increased interest has been shown by the dental profession in the operation of instruments at speeds above the range of 4,000 to 6,000 rpm. One reason for this interest is that diamond instruments and carbide burs are accepted as being more effective in cutting tooth tissue at accelerated speeds. This has shortened the operating time in some instances. It has been observed also that less force is required to direct the instrument, less fatigue results for both the patient and the operator and the patient experiences less apprehension and discomfort when the cutting instrument is operated at increased speeds.

The clinical advantages of accelerated speeds have been studied and adequately described.[1] The correlation of the numerous factors to be controlled in determining the optimum operating speeds and the effect of choice of instruments also have been studied and described.[2, 3] It has been shown that the shape, size and design of the instrument are significant in the selection of the optimum operating speed,[1, 4] and that the use of coolants is essential at increased speeds.[5, 6]

BELT-DRIVEN HANDPIECES

Methods of Increasing Operating Speeds • Several methods are available to the profession for alteration of the operating speeds of the belt-driven, or cord-driven, handpieces. The least expensive and the simplest method is to change the size of the motor and handpiece pulleys. Some manufacturers provide different sizes of pulleys on both the motor and handpiece. When the driving belt, or cord, is on the larger motor pulley and on the small handpiece pulley, the speed of rotation is increased. Special over-size pulleys are available for most standard dental motors. By use of an intermediate system of pulleys, known as a transmission, between the motor and the handpiece, the operating speed also may be altered. The principle generally is the same in any of the systems involving a change in pulley ratio, and an increase in the diameter of the engine pulley by a ratio of two to one over the diameter of the handpiece pulley will increase the operating speed by about the same amount.

Theoretically, there is the possibility that the use of motor pulleys of too great a diameter will reduce the power available to drive the handpiece below practical limits. With the equipment now available, however, this does not seem to be a problem of practical significance. Several manufacturers have reduced the size of the standard handpiece pulley, and motor manufacturers have adopted as standard equipment a pulley slightly larger than older models.

Another inexpensive method for the alteration of the speed is to change the electrical resistors for the motor. This change can be accomplished easily by a service representative of the manufacturer and will increase the effective speed of the handpiece to 8,000 to 16,000 rpm depending on the make and model of the motor available.

For those who wish to obtain new motor units, most manufacturers provide a multiple-speed unit which operates in a range of standard speeds below approximately 8,000 rpm. When an electric switch is thrown to the high range, the speed of the handpiece increases to 18,000

1. Ingraham, Rex, and Tanner, H. M. Adaptation of modern instruments and increased operating speeds to restorative procedures. J.A.D.A. 47:311 Sept. 1953.

2. Vaughn, R. C., and Peyton, F. A. Influence of rotational speed on temperature rise during cavity preparation. J. D. Res. 30:737 Oct. 1951.

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4. Nelsen, R. J.; Pelander, C. E., and Kumpula, J. W. Hydraulic turbine contra-angle handpiece. J.A.D.A. 47:324 Sept. 1953.

5. Henschel, C. J. Friction of revolving steel burs. J.A.D.A. 31:895 July 1944.

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or 22,000 rpm depending on the make and model of engine available. Such units may be modified further by different combinations of motor and handpiece pulleys to cover still a greater range of speeds.

Regardless of the method of increasing the speed of operation, the operator needs to adjust the belt tension carefully to maintain the maximum speed of operation. The speed may be modified by as much as 2,000 rpm or more by the alteration of the belt tension. The relative freedom of rotation of the shaft will alter the effective speed of the instrument. The more resistance the bearings offer to the free rotation of the shaft, the more power is necessary to operate the instrument and the slower will be the speed of rotation. Careful cleaning, adjustment and complete lubrication of the handpiece is necessary, therefore, to keep it running freely at maximum speed.

With all other factors constant, there is some difference in the ease of rotation of different brands of handpieces, even when they are properly adjusted and lubricated. This difference is related to the bearing surface, design and finish. With the same dental motor there will be some difference in the speed of rotation obtainable from two such handpieces.

Care and Maintenance of Equipment • An important feature of the performance and life of the handpiece is the care it receives in service. To keep the instrument operating freely, without excessive heating and wear, it is necessary frequently to clean the bearing surfaces thoroughly. This cleaning removes oil residue, gums and saliva, which, if allowed to accumulate, will cause excessive heating of the bearings with corrosion and damage to the bearing surfaces. After the cleaning operation, complete lubrication with a fine grade of light oil is necessary before the handpiece is put in service again.

As pointed out by Ingraham and Tanner,[1] the use of increased operating speeds makes the problem of care and maintenance of the handpiece even more acute. The instrument needs complete cleaning and lubrication at least daily when speeds of over 10,000 rpm are employed, if damage to the handpiece from wear and overheating is to be avoided. With handpieces and contra-angles operating at increased speeds, the wear and heating normally due to friction can be expected to increase in proportion to the speed. This ratio of heating and wear will be greater than normal, unless the instrument is properly cleaned, lubricated and adjusted regularly. This cleansing routine is not always followed, for the annual cost of handpiece repairs from lack of care is high.

Handpieces with Sleeve Bearings • Whereas most routine operations with rotating instruments are accomplished with the contra-angle attachment, the straight handpiece receives extensive use both as the driving mechanism for the contra-angle and for some direct applications in shaping cavities. Some refinements and alterations of design have occurred recently in the straight handpiece.

The conventional, standard handpiece that has been available to the profession for many years is designed generally to have two major bearings for the drive shaft within the outer sheath or housing. These have been simple friction or sleeve-type bearings in which the smooth bearing surface on the shaft is made to contact the smooth outer bearing surface on the sheath. These bearing surfaces in both the pulley end and the nose of the handpiece are constructed to have only a limited space between them into which the lubricating oil film enters to prevent heating and wear.

The standard handpieces for years have been constructed with such accuracy and precision as to operate smoothly without heating at speeds up

to 6,000 rpm, when properly adjusted by the operator and carefully cleaned and lubricated. These standard handpieces will not usually withstand operating speeds much over 8,000 rpm, however, without showing evidence of excessive heating, wear and vibration.

Handpiece manufacturers have given much time and study to methods for improving this sleeve-type bearing to withstand faster operating speeds. One manufacturer, Midwest, has made some improvement by producing a handpiece with finely honed bearing surfaces which are closely matched to each other. This so-called high speed handpiece will operate well to speeds of approximately 12,000 rpm without becoming overheated, but should not be recommended for use with greater operating speeds. In other respects this handpiece is similar to the conventional design of a well made precision instrument which should give good service for long periods if given proper care. Such refinements in manufacture represent expensive and time-consuming operations and add slightly to the cost of the instrument.

Another manufacturer, Chayes, has made available a sleeve-type bearing handpiece, which makes use of polished glass as the bearing surface surrounding and opposing the metal shaft bearing surface. Glass can be finished to a highly polished surface that offers low frictional resistance to rotation, and retains well a fine lubricating film to reduce further wear and heating during operation. Experience with this straight handpiece indicates that it may be operated successfully at speeds approaching 20,000 rpm and, for short intervals, at speeds of more than 20,000 rpm. The faster the speed of rotation, the shorter the time the handpiece may be operated without excessive heating. Speeds up to 30,000 rpm have been employed with this instrument for 30 second intervals or less for intermittent cutting operations.

It is important to re-emphasize that when using handpieces at this high speed they must be well adjusted, clean and well lubricated to avoid permanent damage to their bearing surfaces. If the nose bearing of the handpiece becomes hot, it will cause discomfort to the tongue or cheek of the patient and may make it uncomfortable for the operator to grasp properly. Usually this overheating can be detected before damage will occur to the bearings. When the handpiece is detected to be uncomfortably warm, regardless of the speed of operation, it should be cleaned, readjusted and relubricated.

Another handpiece (Imperator), manufactured in Europe and now marketed through an American outlet (Kerr), employs a slightly modified sleeve type of bearing. This handpiece employs several novel features in addition to having well finished metal bearing surfaces which are self-aligning on the shaft through application of a ball and socket principle. Such a floating-type bearing surface reduces the tendency of the shaft to bind while rotating, thus permitting the handpiece to be operated at high speeds. Such an instrument may be operated at speeds above 20,000 rpm without excessive heating. For short intervals it has been operated intermittently at speeds from 30,000 to 40,000 rpm without uncomfortable heating. Although this handpiece can be operated safely at increased speeds of rotation, it remains to be determined if the several additional features of over-all dimensions, design, manner of bur mounting and others will prove popular.

Ball Bearing Handpieces • Since 1951 ball bearing handpieces have been studied and developed in the Physical Research Laboratory of the School of Dentistry, University of Michigan, in cooperation with the Office of the Surgeon General, U. S. Army.[7] The essential feature which makes these handpieces different from the conventional hand-

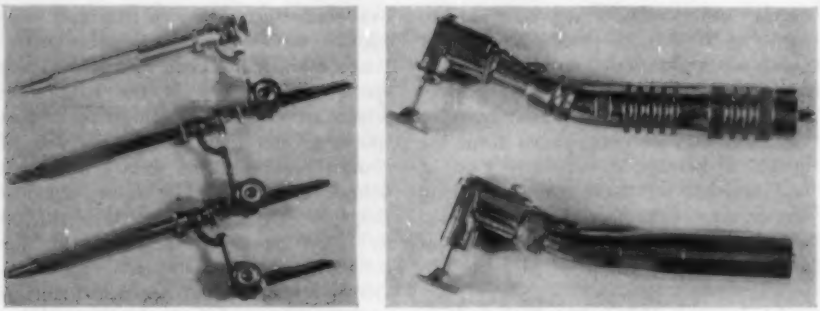

Fig. 1 • Left: Three experimental ball bearing handpieces. Above, aluminum sheath and shaft. Center, chromium plated magnesium alloy sheath and shaft. Below, steel shaft and sheath. Right: Conventional contra-angle, above, compared to experimental model ball bearing contra-angle, below

pieces is that miniature ball bearings are placed between the shaft and the sheath, instead of the friction-type bearing surfaces. The ball bearing handpiece shows considerable promise as an instrument for use at routine operating speeds of more than 25,000 rpm. Three such instruments shown in Figure 1 indicate that ball bearing handpieces are comparable in size to conventional instruments.

Most manufacturers are experimenting with ball bearing handpieces. Two of these handpieces now available, Densco and Midwest, seem to operate satisfactorily at speeds higher than 20,000 rpm without excessive heating, provided they are properly cleaned, adjusted and lubricated the same as sleeve-type bearing handpieces.

There seems to be greater freedom of rotation of the shaft of the handpieces with ball bearings than with the sleeve-type bearing. Less power from the motor is required, therefore, to drive the ball bearing handpiece. With the same motor power output, the ball bearing unit will operate several hundred rpm faster than one with sleeve bearings, depending on the speed range of operation. The outer handpiece sheath does not tend to turn in the hand during operation, as is true of some sleeve-type units, especially when not completely well adjusted.

Vibration within the dental handpiece which may be transmitted both to the operator and the patient is a disturbing quality. It is probably not responsible for a great amount of discomfort, but it is an annoying factor which tends to make the patient tense and apprehensive. Vibration in the instrument causes some lack of precise control in directing the cutting operation by the operator.

Sleeve-type bearing handpieces may be quite free from vibration when properly adjusted. Some difference exists in different handpieces in the degree of vibration observed, and in general the ball bearing handpieces may exhibit slightly more evidence of vibration than the sleeve bearing handpieces at certain speeds of operation.

It should be pointed out that the vibration experienced by the patient and the operator usually is a combination of sensations of vibrations from many sources. Vibrations from the belt, engine arm pulleys, unbalance of shaft and

7. Henry, E. E., and Peyton, F. A. Recent developments in dental handpiece design. (Abst.) J. D. Res. 33:696 Oct. 1954.

cutting instrument, or improper adjustments of the handpiece can account for much more vibration than is observed by comparing ball bearing or sleeve bearing handpieces. A pronounced amount of vibration may be experienced from the use of a handpiece with any kind of bearings that are badly worn from long service. Any of the handpieces mentioned will not exhibit excessive vibration at any speed of operation if properly adjusted.

A related problem which has not been solved completely is the reduction of normal life and the excessive wear that results when handpiece belts, or cords, and engine arm pulleys are operated at increased speeds. The life of the belt is shortened in direct ratio to the increase in speed of operation. Some effort is being made to develop so-called high speed belts, both from cotton and nylon fibers, but as yet the results are not completely successful. At speeds of 20,000 rpm or more, the engine arm pulleys tend to become hot and to wear excessively. Studies are being made with pulleys mounted on ball bearing and other bearing materials, but such changes have not yet become routine. With the conventional pulley system, frequent and complete lubrication is essential if increased operating speeds are employed.

It seems doubtful if operating speeds of more than 12,000 to 15,000 rpm offer much practical advantage, in comparison to disadvantages that may be encountered. While operating speeds of 20,000 to 30,000 can be attained, the life of all the equipment is shortened accordingly. Extreme precaution in care and maintenance is essential. The real benefits to be gained in effectiveness from the cutting instruments at such high speeds have not been well established, and any saving in operating time may be questioned. It has been shown that instruments are significantly more effective at speeds up to 15,000 rpm than at speeds of 4,000 to 6,000 rpm, and equipment is available which will give long and satisfactory service with reasonable maintenance and care when operated at this speed or less. Any of the handpieces which are capable of being operated at speeds greater than 15,000 rpm will, of course, give excellent service at speeds below this value. The most practical range for speed still seems to be 12,000 to 15,000 rpm, an increase from the conventional 4,000 to 6,000 rpm previously employed. Further refinements in equipment may shift the optimum speed upward in the future.

Contra-Angles for Use at Increased Speed • Up to the present there has not been the same improvement in the contra-angle handpiece that has occurred in the straight handpiece and motor. Since many routine operations are performed with the contra-angle, the maximum speed of operation is often limited because the contra-angle will not withstand excessive speeds without significant heating, wear and damage. It is to be emphasized that a strict routine for adjustment, cleaning and lubrication of the contra-angle bearings and gears is essential if increased speeds of rotation are to be employed. Several instruments are available which can be operated successfully at speeds of 10,000 to 15,000 rpm for routine services, but most contra-angles do not seem to be suitable for speeds of more than 20,000 rpm.

Most conventional contra-angles make use of the friction-type bearing with a relatively simple matched gear system at the angles of the drive shaft. This system is reasonably satisfactory when relatively slow speeds of 4,000 to 6,000 rpm are employed. The use of ball bearings in the contra-angle to replace the sleeve-type bearings has been studied.[7] Such a ball bearing contra-angle compared to a conventional one is shown in Figure 1, right. Although more effort is needed on this problem, the use of ball bearings in contra-angles for high speed opera-

tions seems promising. Some simplicity of design in the gear system also seems possible. It has been determined that contra-angles with the same relative dimensions can be designed with ball bearings as with sleeve bearings. Some manufacturers have experimented with suitable designs for ball bearing contra-angles, and it seems probable that one or more products may be available in the near future. If so, it seems probable that they will be directed to applications of increased speeds.

A variety of different designs of contra-angles are available for use with the Imperator handpiece. In general, these make use of modified sleeve-type bearings which are relatively free from vibration and excessive heating.

In an effort to overcome one source of vibration in the contra-angle, at least three manufacturers (Densco, Chayes and Midwest) have employed a long sheath on the contra-angle rather than the customary short sheath that attaches to the nose of the straight handpiece. In some instances the long sheath is attached to the regular straight handpiece sheath, whereas in others it replaces the straight one. In either instance there is some stability from vibration that results from the increase in length. This stability seems particularly noticeable at increased operating speeds.

Either air, water or a water spray directed on the rotating instrument and tooth region being cut is essential when using increased speeds. The use of such coolants has the beneficial effect not only of lowering the temperature in the field of operation but also of cooling the contra-angle tip to some extent. The amount of cooling of the instrument varies with the coolant used and the method of its application. One manufacturer, Chayes, has a small metal tube for the coolant, attached intimately to the contra-angle tip, with the water spray outlet directed toward the rotating instrument. This method seems to be effec-

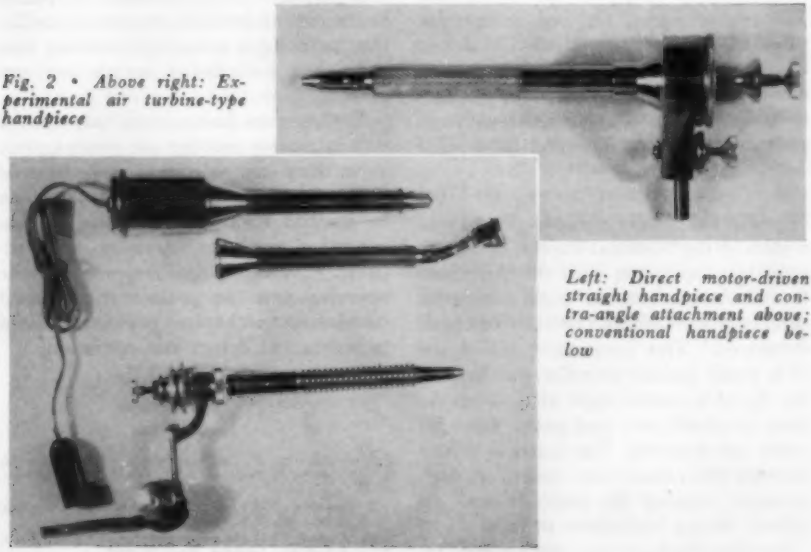

Fig. 2 • Above right: Experimental air turbine-type handpiece

Left: Direct motor-driven straight handpiece and contra-angle attachment above; conventional handpiece below

tive in reducing the temperature in the contra-angle. Experience has indicated that when the instrument is rotating at speeds up to 20,000 rpm, it remains adequately cooled when the spray is operating. Speeds much beyond 20,000 rpm do not seem advisable for extended periods of time.

Interest often centers on the taper shank-type instrument in contrast to the more conventional latch-type instrument for freedom from vibration. Many of the chief sources of vibration such as gear systems, unbalanced shafts, engine arm pulleys and driving belts, of course, are common to both instruments. The taper shank instrument offers some advantage in freedom from lateral movement during the rotation of the instrument. It is possible, therefore, to direct the instrument to cut parallel walls or a more true dimension when the more rigidly supported taper shank-type instrument is employed than with the less rigidly supported latch-type instrument.

FLUID TURBINE HANDPIECES

The use of water, air and compressed gases as a source of power for dental handpieces is not new.[4, 8-10] Such instruments have been in existence for 75 years or more. Recent developments with experimental models, however, show some interesting results.

Liquid-Driven Handpieces • From studies at the National Bureau of Standards, in cooperation with the American Dental Association, an ingenious water turbine-type handpiece recently has been developed.[4] This instrument makes use of a small turbine impeller mounted in the tip of a contra-angle shaped instrument to which inlet and outlet tubes for water are attached. The water is driven through the closed tube system at high pressures causing the impeller and attached cutting instrument to turn.

Another turbine-type instrument recently developed at the University of Michigan, School of Dentistry, makes use of compressed air as the fluid to drive the impeller.[7] This unit resembles a conventional straight handpiece with the shaft mounted on ball bearings, and the impeller in a position corresponding to the pulley on a conventional handpiece, as shown in Figure 2, above right.

A feature of fluid turbine-driven instruments is the high rotational speed at which they operate. The air-driven unit rotates at approximately 75,000 rpm when cutting and at speeds well above this value when running freely. The water-driven unit is described as operating at approximately 60,000 rpm.

Both instruments are free from the usual engine arm and belt sources of vibration. The air-driven handpiece makes use of a separate contra-angle attached in the conventional fashion, whereas the water-driven unit is of such design that no additional contra-angle is necessary. Each instrument cuts tooth tissue effectively with a low pressure application, because of the high rate of rotation. When a heavy pressure is applied to the cutting instrument it stops readily, thus reducing a potential operation hazard when exceptional speeds are employed.

Each of these instruments has potential uses in routine practice. At present, their value may be chiefly in experimental studies at very high speeds. Much can be learned regarding operating speeds, operating pressures necessary to effectively remove tissue, response of the operator and the patient to increased speeds and mechanical problems related to instrument design and operation.

8. Straub, A. W. Improvement in instruments for giving motion to tools. U. S. Patent No. 154,569, Sept. 1, 1874.

9. Laurence, Henry. Improvement in dental engines. U. S. Patent No. 213,909, April 1, 1879.

10. Norlen, P. I. Dental engine for compressed air. U. S. Patent No. 2,618,064, Nov. 18, 1952.

DIRECT MOTOR-DRIVEN HANDPIECE

A dental handpiece with an attached electric motor capable of operating at speeds up to 10,000 rpm has been developed at the University of Michigan, School of Dentistry, as a part of the project sponsored by the U. S. Army.[7] This instrument represents an inexpensive, portable, lightweight unit that has considerable flexibility in its applications. The motor may be operated either from a low voltage direct current battery system or from a transformer-rectifier system attached to the 110 alternating current circuit. Such a handpiece has possibilities for service in hospital operating rooms or in bedside operations. The handpiece is easily detached from the motor for sterilization. An instrument of this kind has possibilities for use in remote rural areas, in military field service or on scientific expeditions where only battery power is available.

The handpiece as now designed has essentially the same features as a conventional belt-driven handpiece (Fig. 2). It is free from excessive vibrations, is well balanced in weight distribution and will perform the routine operations of a conventional handpiece. It is not anticipated that this type of instrument would replace the conventional handpiece, but it does show promise for special applications. At present the instrument is available only for experimental studies.

SUMMARY

This report describes and evaluates some of the recent improvements and developments in dental handpieces which make them suitable for increased speeds of rotation. The methods of producing increased operating speeds and the need for careful cleaning, adjustment and lubrication of the handpieces is described. More development is necessary in the contra-angle handpiece, driving belts and engine arm pulleys before the conventional handpiece can be operated at increased speeds without damage to the instruments.

Straight handpieces with sleeve bearings are being altered to withstand higher operating speeds, and ball bearing handpieces have been developed which operate at high speeds with less power. The development of experimental contra-angles with ball bearings seems promising.

New fluid-driven handpieces which operate at high speeds are being studied. One of these handpieces uses water and another uses compressed air to drive the impeller.

A handpiece driven by an electric motor which can be used where only battery power is available has been developed.

Further improvements in dental handpieces probably will continue. Speeds that are now considered relatively high may be considered moderate as further refinements are developed. No doubt exists that increased operating speeds with rotating instruments can be employed to the advantage of both the patient and the operator, if fundamentally sound and acceptable operating practices continue to be followed in shaping the cavity in the tooth.

Ultrasonic dental cutting instrument: I

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Current operative methods for cavity preparation have a number of inherent disadvantages. Rotary instruments employing the recently introduced increased speeds and modified cutting instruments have allowed more rapid cavity preparation, but the frictional heat and vibration during cutting may cause pain, trauma and apprehension to the patient. The air abrasive technic for cavity preparation is acceptable to the patient but is limited to the teeth in the direct vision of the operator. The air abrasive technic deprives the operator of tactile control during cutting; acceptable cavity preparation, therefore, is difficult. Rotary instruments are required also for the completion of the preparation.

The recent industrial development of a method of cutting hard substances by means of high-frequency vibrating tools in conjunction with an abrasive slurry[1-3] led to an investigation of the application of such a method to dental cutting problems. The purpose of the investigation, of which this paper is the first report, is to determine the feasibility and the efficacy of the new cutting method in the preparation of cavities from both the patient's and the operator's points of view.

The object of this paper is to present the following:

1. A brief description of the development of an instrument to cut hard dental structures by using an imperceptible, high-frequency, mechanical vibration in conjunction with an abrasive slurry. It is not within the scope of this paper to discuss the engineering details of the instrument's construction or the electronics of the power source.

2. A method developed for using the instrument in preclinical trials.

3. Observations made during the initial stages of instrument development, the implications of these observations for clinical applications and recommendations for further investigation.

INSTRUMENT DEVELOPMENT

The high-frequency mechanical vibration necessary for the operation of the new instrument may be produced by

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The opinions or assertions contained herein are the private ones of the writers and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

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1. Ultrasonic carving machine. Life 33:97 Nov. 3, 1952.

2. Cohen, A. S. New method machines: sintered carbides, sintered borides, hardened tool steels. J. Metals 3:216 March 1951.

3. Kelley, S. G., Jr. Hard, brittle materials machined using ultrasonic vibrations. Materials & Methods 34:92 Sept. 1951.

either a magnetostrictive or a piezoelectric transducer of high-frequency alternating current.[4] The principle of magnetostriction was discovered by Joule in 1847[5] and since then has been used extensively. The application of high-frequency mechanical vibration to dental cutting was suggested by H. Hayes in 1934.[6] The use of an abrasive slurry at the cutting tip[7,8] increases the cutting speed very greatly. Preliminary trials indicated that a transducer using magnetostriction was better suited to the construction of a compact, reliable instrument.

The basic transducer (Fig. 1) consists of a magnetized, cylindrical nickel tube around which a coil is wound. The application of alternating current to the coil produces an intense vibration of the tube when the alternating current frequency is exactly that of the longitudinal free vibration of the tube. The central transverse plane of the tube, the nodal plane, indicated in Figure 1, is a plane in which no extension or contraction of the tube takes place.

The frequency selected is determined by several considerations. Dental instrument size is the most important. Low frequencies are audible and require a long transducer tube. High frequencies produce only very small amplitudes of vibration and, therefore, would reduce the cutting rate of the instrument. A compromise was made in the selection of a frequency of 25 kilocycles per second. At this frequency a nickel tube approximately 4 inches long will give maximum resonance and is one-half the wave length of the sound in the tube. Since the upper limit of hearing is near 15,000 vibrations per second, the frequency selected is inaudible and is referred to as ultrasonic.

A simple magnetostrictive cutting instrument (Fig. 2) is the basic vibrator modified for use. An outer jacket has been added to provide a means of handling. The nickel tube is supported only at the nodal plane to avoid interference with the vibration. The magnetizing system has been condensed to a pair of rings attached to the ends of the handling sleeve. A cutting tip also has been added, and the device has been completed by the addition of a cooling system. The current in the coil and the friction of the vibration produce heat, which is removed by circulating water.

The cutting instrument in its current stage of development is 4½ inches long

4. Wood, Alexander. Acoustics. Student's physics, vol. 2. New York, Interscience Publishers, Inc., 1941.

5. Joule, J. P. On the effects of magnetism upon the dimensions of iron and steel bars. London Phil. Mag., Series 3, 30:76 Feb. 1847.

6. Hayes, H. C. Impact tool, U. S. Patent, no. 1,966,446, July 17, 1934.

7. Balamuth, L. Method and means for removing material from a solid body. U. S. Patent, no. 2,580,716, Jan. 1, 1952.

8. Bodine, A. G. Method and apparatus for cutting materials. U. S. Patent, May 19, 1953, Re 23,657, original filed Dec. 12, 1942.

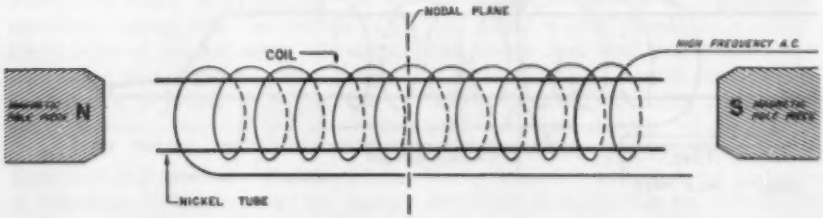

Fig. 1 • Schematic drawing of a simple magnetostriction vibrator showing magnetized nickel tube, the coil for high-frequency alternating current and position of nodal plane

and ¾ inch in diameter, and weighs about 5 ounces with its circulating water. The electric power for the instrument is obtained from a power amplifier, which, in turn, is driven by a small oscillator (Fig. 3). Power to the cutting instrument is controlled by a foot switch.

The operation of the instrument includes the following procedures:

1. The alternating current frequency is adjusted by turning the tuning dial on the power control panel to produce the maximum vibration of the cutting tip. This is recognized by holding the tip vertically against a glass plate, listening for a slight singing sound and feeling the vibration within the instrument. Improved instrument design can provide automatic frequency adjustment.

2. The abrasive slurry which is applied to the cutting tip and the material to be cut consists of a thick mix of aluminum oxide (particle size 30 microns) and water. A continuous application of the slurry is necessary during the cutting procedure. In an improved instrument design, it would be possible to place lines for the delivery of slurry and flushing water within the tube transducer.

3. Initial cutting is accomplished with very light pressure to avoid a "walking effect" of the cutting tip. Once a cut is established, this effect disappears.

EQUIPMENT AND MATERIALS IN RELATION TO CUTTING

Effect of Instrument Design on Cutting Rate • Cuts were made in the direction of vibration through ¼ inch glass plate in 70 seconds with a 1 by 4 mm. cutting tip (Fig. 4). The pressure applied was the weight of the instrument, that is, 5 ounces. Cutting in this manner is comparable to cutting with a straight handpiece.

A contra-angle instrument was made by bending the cutting tip forward and down at an angle of approximately 90 degrees to the direction of vibration. Application of this tip to the glass produced a cut (Fig. 4), which was not a negative of the cutting tip as in the case of the cut made in the direction of vibration. Rather, the cut produced was 2 mm. in the direction of vibration by 4 mm., the width of the tip. Penetration of the ¼ inch glass plate in this manner required approximately 15 minutes.

Since the cuts produced in the direc-

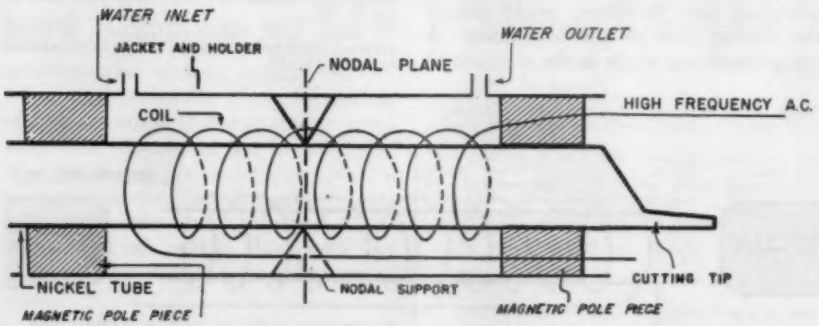

Fig. 2 • Schematic drawing of simple magnetostriction cutting instrument showing outer jacket and holder with cooling water inlet and outlet, position of permanent magnetic pole pieces, nickel tube with cutting tip added and its nodal support, and coil for high-frequency alternating current

tion of vibration were performed so much more rapidly than those produced at an angle of 90 degrees to the direction of vibration, it appears that the vibrations were not transmitted around an angle of 90 degrees with this particular transducer. Cutting proceeded chiefly in the direction of vibration, in spite of efforts to cut at an angle to that direction. Clinical technics, apparently, must utilize the instrument cutting in the direction of vibration for most efficient cutting, or else a method must be devised for transmitting the vibrations around an angle.

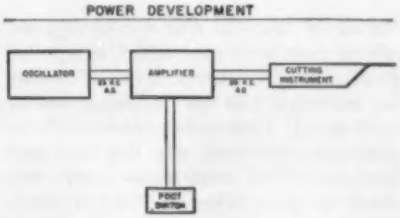

Fig. 3 • Block diagram of power for ultrasonic cutting instrument showing foot switch control

Method of Attaching the Cutting Tip to the Transducer • It is anticipated that the clinical use of the instrument will require interchangeable cutting tips. Several methods of accomplishing this were attempted.

One method was to attach the tip to the transducer by means of a screw thread. Changing tips this way was satisfactory, but cutting proceeded at a reduced rate, apparently because the vibrations were not fully transmitted through the screw thread. Another method was to extend the transducer itself to form a cutting tip, eliminating any need for attaching a tip. With this method, a change of cutting tip is accomplished by changing the entire transducer, which can be done readily. Of the methods tried for changing cutting tips, the latter proved most acceptable and is the present method of choice.

Instrument Power Requirements • The maximum cutting rate was reached at a power input of approximately 400 watts. It is hoped that improvements in instrument design will result in a much lower power requirement.

Amplitude of Vibration • The amplitude of vibration of the cutting tip under maximum cutting conditions was estimated to be several microns. This corresponds to a peak acceleration of the cutting tip of several thousand times that of gravity and accounts in part for the power requirement. A close relation appeared to exist between the amplitude of vibration and the rate of cutting. A further study of this relation should be conducted to determine the optimum amplitude of vibration.

Abrasive Material Used • The abrasive material, a thick mix of aluminum oxide and water, was applied intermittently, as required, to the tip during cutting. Repeated applications were necessary because the mix dried during operation and was dissipated by the vibration. A higher cutting rate was possible with a thick mix than with a thin mix. Neither the powder nor the water could be used alone for cutting. Various powder: water ratios should be tested to determine the most suitable ratio.

Several types of powders are available for abrasives. Each of these should be tested for its effect on the cutting rate. The ideal material would be nontoxic, inexpensive and readily available.

Although this process of cutting is not fully understood, the cutting rate is probably influenced by the physical characteristics of the abrasive agent used, the energy imparted to it and the vibration amplitude of the cutting tip. The amplitude of vibration should be greater than the particle size. These factors should be investigated thoroughly.

Nature of Material Cut • Although no cutting rates were established, except for glass, cuts were attempted in the following materials and the following results were noted: Cuts were made readily in glass, extracted teeth, vital dog teeth and amalgam. Cuts were made only very slowly in gold, silver and acrylic resin. Cuts were impossible in soft tissue and soft carious dental material. The ease of cutting seemed to increase with the hardness of the material to be cut. The clinical significance of this is that cutting will be most efficacious when applied to hard dental structures, such as enamel and dentin, and the hard dental materials,

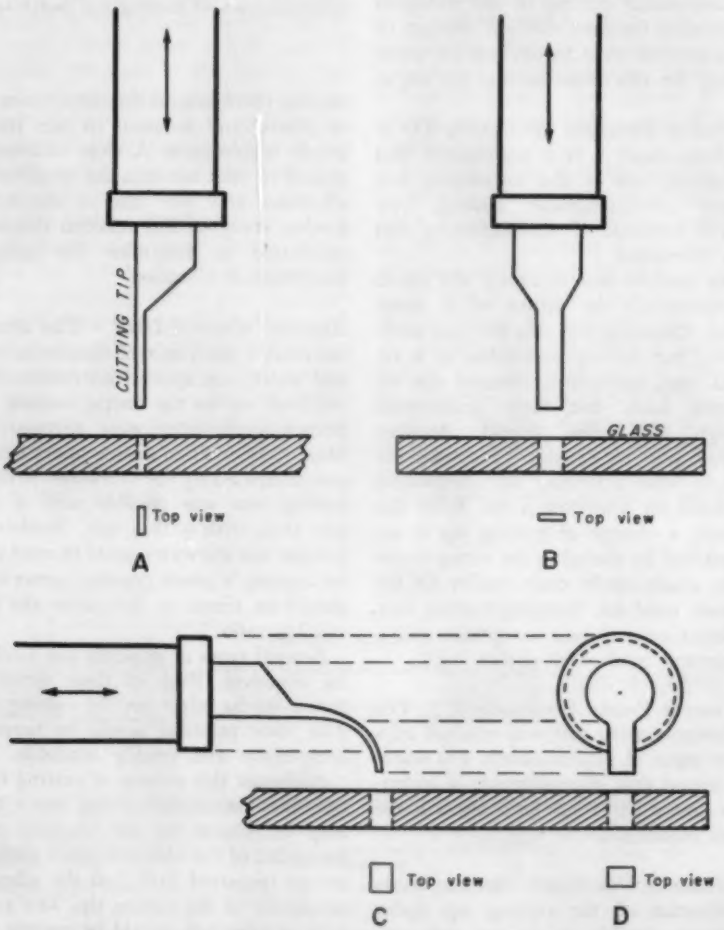

Fig. 4 • Schematic representation of cuts produced. A, B: In direction of vibration indicated by arrows. C, D: At right angle to direction of vibration

such as amalgam, the silicate cements and porcelain teeth and facings. The cutting of soft tissue, gold and plastics, or the removal of soft carious material, must be accomplished by other means.

It was observed that the corners and angles of the nickel cutting tip showed wear after considerable use. Further study of tip life is needed before the clinical significance of these observations can be evaluated.

CONTROL OF INSTRUMENT

The degree of control of the instrument is a vital factor in cavity preparation, both from the point of view of the operator and the patient. The most satisfactory method of holding the instrument is to grasp it lightly as one would a fountain pen. Manipulation of the instrument with its flexible tube connections is much more satisfactory than manipulation of the conventional engine arm and handpiece arrangement. Satisfactory cutting is obtained when pressure equal to the weight of the operating instrument is used. This weight is 5 ounces. When additional pressure was applied, the rate of cutting was reduced. Pressures of less than 5 ounces were not tried. Further studies would be helpful in determining the best pressure to use. The slight pressure requirements should reduce fatigue considerably in operator and patient. Excellent control of the instrument is possible, since the amount of control is inversely proportional to the pressure required to operate the instruments.

Cavities were prepared in extracted teeth, and it was observed that there was no tendency of the cutting tip to bind, run, dart or jump. There was a slight "walking effect" of the cutting at the beginning of a cut. This effect was controlled easily by holding the instrument more firmly to steady it until a cut was established. During operation there was no feeling of vibration in the fingers holding the instrument. The operator had tactile control of the location, direction and position as well as the extent of the cut since the position of the cutting tip determined the cut extent. This control made possible the production of sharp line and point angles, flat floors, and straight walls in cavity preparation. Visual observation during cutting was impaired by the presence of the abrasive slurry. Visual determination of the extent of a cut, however, was accomplished by removing the tip and flushing away the slurry. Clinical use of the rubber dam should facilitate the localization and removal of the slurry. This instrument will not injure the soft tissues or foul the rubber dam.

HEAT PRODUCTION

The internal production of heat in magnetostrictive devices is well known. In industrial applications of the principle of magnetostriction, a coolant to dissipate the heat created usually is provided. Some of the difficulty encountered in the development of the present dental instrument arose from the problem of heat. There are several sources of heat associated with the operating instrument:

1. Electric resistance in the coil used to produce the alternating magnetic field.
2. Electric eddy currents which are set up within the nickel transducer.
3. Molecular friction resulting from the magnetostrictive action within the transducer.
4. The working friction between the vibrating tip and the material being cut.

Elimination or control of the heat is of prime concern, as heat is a possible source of pain and trauma to the patient. Energy lost as heat also increases the power requirement of the instrument. In the present instrument, circulating water is used to remove the heat from the coil.

A longitudinal slot in the transducer reduces the heat from the eddy currents. The abrasive slurry acts as a coolant to remove molecular and working frictional heat from the cutting tip. Improved instrument design is expected to reduce the heat problem still further. The use of laminated materials for the transducer construction should eliminate heat from the eddy currents. Much further work is needed to determine the comparative amounts of heat from each source and the means for eliminating, dissipating or controlling each one. The amount of heat produced within a tooth during cutting also should be determined.

PRELIMINARY ANIMAL STUDIES

Preliminary animal studies were conducted to ensure the complete safety of the patient in any subsequent clinical application. Cavities were prepared in vital dog teeth to determine the biologic response to the use of the instrument. The methods followed and the results obtained will be presented in a separate report. The studies to date seem to indicate that the biological effect is comparable to that of conventional rotary instruments.

PROJECTED CLINICAL APPLICATIONS

In anticipation of clinical problems, various methods were used to prepare cavities in extracted teeth. One such method involved several steps:

1. A model was made of an extracted tooth.
2. A cavity was prepared in the model.
3. A gold inlay was made for the cavity.
4. The gold inlay, attached to the cutting tip of the instrument, was used as a die in the preparation of the cavity.
5. The inlay was detached from the cutting tip and cemented in the cavity.

This method may have merit. The orientation of the inlay to the tooth, however, presented the outstanding problem. Even if the die method is not completely practicable at present, modifications of it might be. For example, cutting tips of various shapes might be made and used to prepare the different segments of a cavity.

GENERAL DISCUSSION

Much of the effort to date has necessarily been devoted to the construction of a workable, controllable instrument. Despite the problems encountered, there seems no reason to believe that a magnetostrictive device for dental operative purposes is not a sound, practical piece of equipment from the mechanical standpoint. Its development thus far indicates that it is capable of accurate, noise-free cutting of hard dental structures. It has demonstrated these possibilities on inert materials and awaits further improvement and further testing on biologic specimens and extracted teeth before it can be introduced to clinical practice.

Biological and clinical testing is now under way to accumulate objective as well as subjective data. Any predictions about the eventual role of this instrument in the clinical preparation of cavities are premature.

SUMMARY

A dental cutting instrument using ultrasonic mechanical vibration with an abrasive slurry has been developed and studied in preclinical trials. The instrument is composed of a transducer using magnetostriction and operates at a frequency of 25 kilocycles per second.

Accurate cutting of hard dental structures and materials was accomplished rapidly. The ease of cutting seemed to increase with the hardness of the material cut. The power requirement for the best rate of cutting was 400 watts. Cuts in the

direction of vibration were produced the most rapidly.

Excellent control of the instrument was possible and only slight pressure was necessary for operation. The abrasive slurry, however, obstructed observation of the cutting.

More testing is necessary to determine the role of the instrument in the preparation of cavities.

Ultrasonic dental cutting instrument: II

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The initial report[1] of this investigation described the construction of a magnetostrictive device and its use with an abrasive slurry to accomplish cutting. The instrument reported was constructed from a nickel tube, used as a transducer to convert electrical energy to mechanical energy, with one end of it shaped into a cutting tip. By electrical means (magnetostriction), the tube, or transducer, could be made to vibrate longitudinally at a frequency above the range of human hearing. It should be pointed out that the only ultrasonic feature of this instrument is its range of vibration.

Cutting was accomplished by applying the mechanically vibrating cutting tip and a mixture of an abrasive powder and water to the material to be cut. The stroke, or amplitude of vibration of the instrument, was computed to be approximately 10 microns. The entire report stressed the need for further investigation into the biological effects and physical aspects of the process to determine its role in operative dental procedures.

To carry forward the indicated investigations, studies were initiated in both the biological and the physical fields.

It is the object of this paper to report the results of several exploratory studies which were undertaken to furnish information about the physical characteristics of the instrument and to aid formulation of a technic for clinical operation.

EFFECT OF PRESSURE ON CUTTING RATE

A study was undertaken to determine what pressure the operator should use in order to obtain a maximum cutting rate.

Presented as part of a panel discussion "Newer Devices for Cutting Tooth Structure" before the Sections on Operative Dentistry and Research, ninety-fifth annual session, American Dental Association, Miami, Fla., November 9, 1954.

The opinions or assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

Commander, Dental Corps, U. S. Navy, U. S. Naval Dental School.

1. Nielsen, A. G.; Richards, J. R., and Wolcott, R. B. Ultrasonic dental cutting instrument: I. J.A.D.A. 50:this issue March 1954.

Materials and Methods • A laboratory setup was prepared for testing the physical characteristics of the instrument (Fig. 1). The equipment was arranged so that operating conditions could be maintained constant and the various factors could be controlled for special study. The cutting instrument was mounted on a balance in such a manner that the pressure applied to it during cutting could be controlled. The setup included a means for delivering a uniform mix of abrasive slurry to the cutting site and for removing the used slurry and debris.

In order that the effect of pressure on cutting rate could be studied, cuts were made in ¼ inch glass plates 1 inch square, each weighing approximately 10 Gm., at pressures which ranged from 20 to 500 Gm. Cutting rates were determined at intervals of 20 Gm. The cutting rate was found by computing the weight loss of the glass plate during cutting. The plates were weighed to 0.10 mg. Tests were made with three different transducers, and the cutting rates were charted on a graph (Fig. 2).

Results • Run A, not pictured on the graph, was made to smooth out operating problems in the setup, and the cutting rates were not recorded.

In Run B, the cutting rate progressed in proportion to pressure up to 140 Gm., but thereafter there was no regular relation between them.

In Run C, the cutting rate progressed irregularly in proportion to pressure up to 170 Gm., but then dropped off rapidly at greater pressure and seemed to remain almost constant at 300 to 500 Gm.

In Run D, the same initial characteristics were observed as before, except that maximum cutting rates were reached at about 300 Gm. Then the cutting rate became irregular at increased pressure.

Discussion • On the basis of these three runs, it appears that the results obtained with one transducer could not be reproduced with another of the same material and design. Each transducer, apparently, has its own characteristics, although it was noted that in the initial phases of each run, the cutting rate increased proportionately with pressure. It appears that unrecognized factors were operating to produce such erratic results. No attempt will be made to draw conclusions about the effect of pressure on cutting

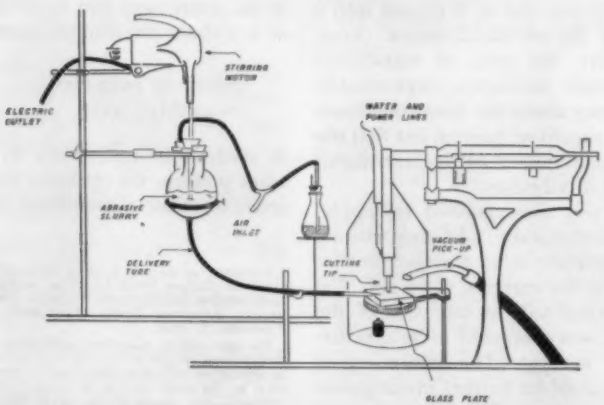

Fig. 1 • Laboratory setup for testing physical characteristics of the instrument

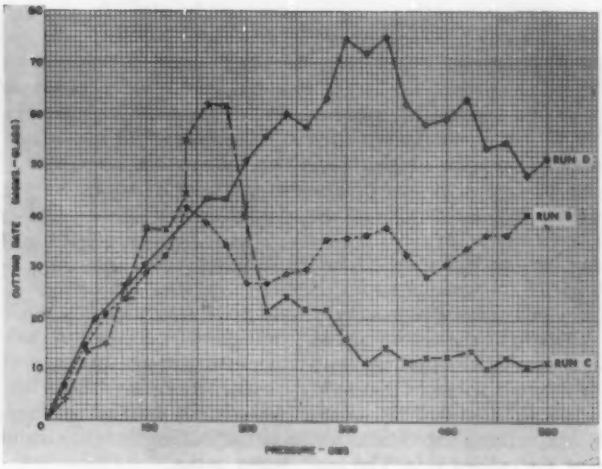

Fig. 2 • Relation of cutting rate to pressure

rate. This study indicates that further investigation is necessary, and that a search must be made for unknown variables involved.

COMPARISON OF CUTTING RATE WITH PERIOD OF TRANSDUCER USE

The erratic and unpredictable performance of the transducers in the pressure study raised the question whether the transducer maintained a constant cutting rate. A study was undertaken to observe the cutting rate over a period of time.

Materials and Methods • For this study, the laboratory setup was the same as it was for the pressure study. A pressure of 150 Gm. was selected arbitrarily and maintained constant. A series of one minute cuts in glass plates was made throughout the study. The slurry, as in the pressure study, was a 50 per cent powder:water mixture. The powder was aluminum oxide with an average particle size of 30 microns. A spot check of the cutting rate was made at every fifth cut. Two transducers were tested, and the cutting rates were charted (Fig. 3). The length of each transducer was measured before and after testing to determine the loss in length during the test. When Transducer 1 (T-1) was tested, the cutting proceeded at an unsatisfactory rate for 32 minutes. It was considered that the amplitude of vibration might have changed. To correct this situation, the frequency of vibration was readjusted at the power source for maximum amplitude. The readjustment resulted in only a somewhat poorer performance. After eight minutes of this, it was considered that the metal might have become hardened by work; therefore, the transducer was annealed. After the annealing, however, the performance was even poorer. After four more minutes of use another effort was made to improve the cutting. Since the cutting tip had become rounded through use, ¼ inch of it was removed and the end was squared to regain the original shape. After the frequency was readjusted for maximum amplitude, the performance

improved, but not significantly.

A test of Transducer 2 (T-2) was made over a period of continuous use.

Results • Although the cutting rate of Transducer 1 varied, it was consistently low. Efforts to increase the cutting rate by readjusting the frequency and by annealing resulted only in a reduced cutting rate.

The cutting rate of Transducer 2 improved with use of the instrument up to a point, after which it became erratic.

The loss in length of the cutting tip of the two transducers after approximately equal periods of use is noted in Figure 3. The results seem to show that the wearing away of the cutting tip is roughly proportional to the cutting rate. The loss in length for Transducer 2 was slightly more than twice that for Transducer 1, yet the maximum cutting rate was more than twice as high. It seems, therefore, that the faster the cutting is, the greater the wear.

Discussion • The results obtained with one transducer could not be reproduced with another. This was noted in the pressure study also. It appears that each transducer has its own unpredictable characteristics. In this study, even the initial phases of operation were dissimilar. Perhaps the variation in transducer performance with use is one of the factors responsible for erratic performance in the pressure study.

CUTTING RATES FOR VARIOUS POWDER: WATER RATIOS

As previously stated, a slurry of 50 per cent powder was used in the studies dealing with pressure and use of the transducer. This ratio was selected arbitrarily. A study was initiated to observe the effect on the cutting rate of various powder: water ratios.

Materials and Methods • The same laboratory setup was used as in previous studies. Pressure was maintained constant at 150 Gm. The powder content of the abrasive slurry was varied from 10 per cent to 70 per cent, at intervals of 10 per cent. Two cutting rates were taken, in the usual manner, with each change in powder: water ratio. In addition, cutting

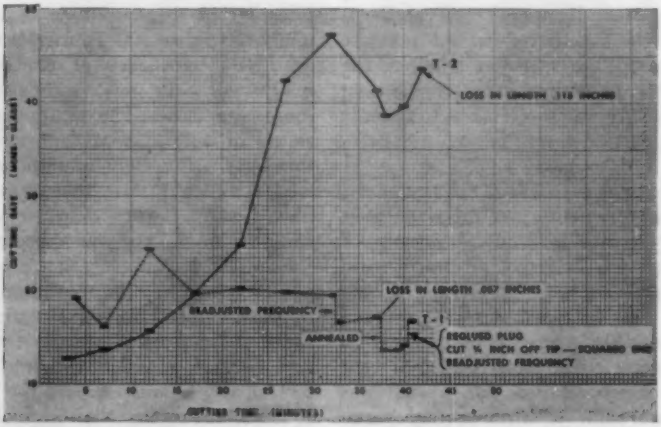

Fig. 3 • Comparison of rate of cutting with period of use of transducer

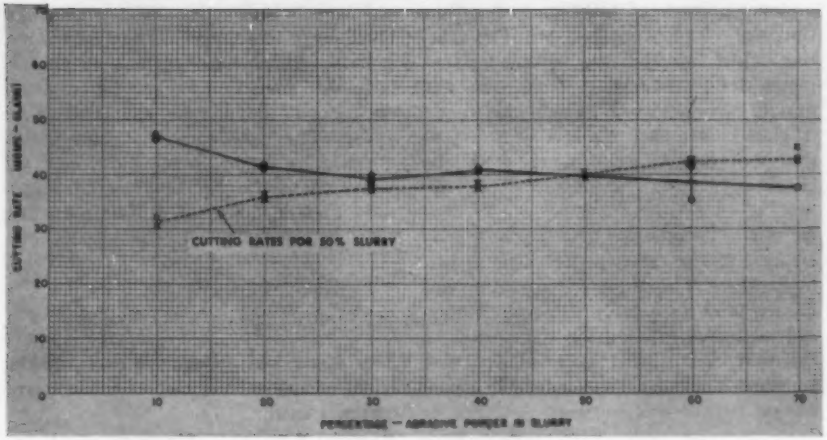

Fig. 4 • Cutting rates with various powder:water ratios

rates with a slurry containing 50 per cent powder were taken with each change in powder:water ratio to permit correction for variable instrument performance.

Results • The cutting rates in relation to the various powder:water ratios are shown in Figure 4. The curve indicates that the cutting rate with the slurry of which 10 per cent was powder was slightly better. Slurries which were 60 and 70 per cent powder proved to be too thick for convenient handling. The cutting rates with the slurry containing 50 per cent powder, which were taken at the various powder:water ratio intervals, were plotted on the same graph. The curve shows that instrument performance improved as the test progressed.

Cutting rates for various powder:water ratios should be considered in the light of instrument performance. Since instrument performance improved, the cutting rates shown can scarcely be accepted as true. Accordingly, an adjustment for the cutting rate at each powder:water ratio was made in view of changing instrument performance, and the adjustments were charted (Fig. 5). Here, perhaps, is a more nearly accurate picture of the relation of powder:water ratio to cutting rate.

Discussion • Instrument performance again changed with use. In this study, a slurry composed of 10 per cent powder appeared to give the maximum cutting rate for the material cut, glass. Whether the results would have been the same with other materials is not known.

CUTTING RATES IN VARIOUS MATERIALS

In the formulation of a clinical technic, it is essential to know the relative cutting rates for various dental materials. A brief study was made of this problem.

Materials and Methods • The laboratory setup previously used was modified to permit a relative measure of penetration of the cutting tip into the material cut (Fig. 6). Test blocks of dental materials, glass, dentin and enamel were placed under the cutting tip. They were cut

under a pressure of 150 Gm. and with a slurry of 10 per cent powder. The relative depth to which the cutting tip had penetrated the test material in one minute was observed. A cut was made in glass before each material was cut, so that instrument performance could be checked.

Results • The comparative depth of penetration of the materials tested is shown in Figure 7. The units of penetration are relative and do not represent any standard measurement. During the period of this test, instrument performance was constant, and no correction of the penetration figures was necessary.

Discussion • This study shows the relative cutting rates of the materials tested rather than the relative weight of material removed. The clinical operator is more concerned with bulk removal than with removal of weight. This study does not appear to support the assumption made in the previous report[1] that the cutting rate is directly proportional to the hardness of the material. Glass, of course, is harder than the cements, and enamel is harder than dentin, yet the rates of cutting in the harder materials were lower. The powder:water ratio which appeared optimum in the slurry used for glass may not be the best for other materials, and, in addition, optimum cutting pressures may vary with the material cut.

CUTTING RATES OF VARIOUS ABRASIVE MATERIALS

This study was conducted to learn the effect on the cutting rate of the abrasive material used.

Materials and Methods • The laboratory setup as modified for the previous study was used. Glass blocks were cut under 150 Gm. pressure and with a slurry containing 10 per cent of the abrasive material being tested. The relative penetration of the cutting tip was measured over a one minute period. Three cuts were

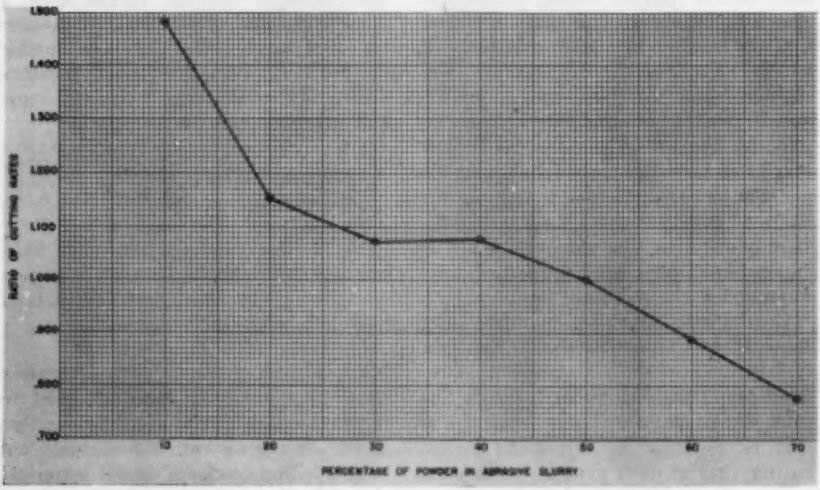

Fig. 5 • Powder:water ratio curve adjusted for instrument performance

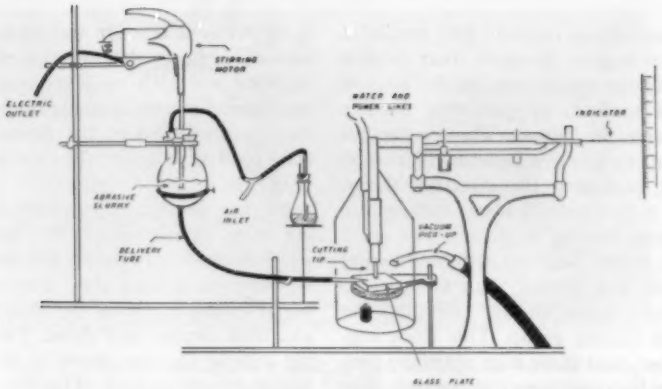

Fig. 6 • Laboratory setup modified

made with each abrasive material tested, and the mean was computed for the cutting rate for that material. So that performance of the instrument could be checked, cuts were made with a standard slurry containing 10 per cent aluminum oxide (30 micron particle size) before and after each two materials had been tested.

Results • The relative cutting rates for the abrasive materials are shown in Figure 8. The values for the cutting rates were corrected for instrument performance. The mean of instrument performance throughout the study was taken as standard. When performance fell below the mean, the value obtained for the abrasive material was increased to compensate for reduced performance. When performance improved, the value was decreased proportionately.

Only two main kinds of abrasive materials were used in this study: aluminum

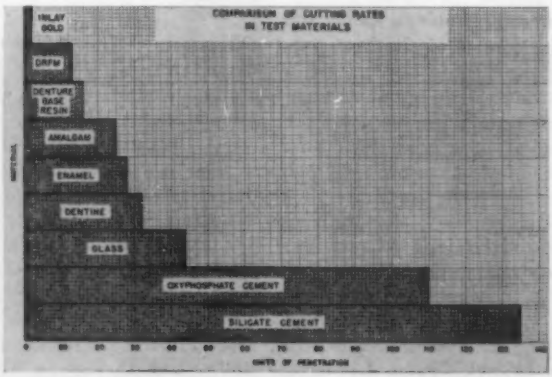

Fig. 7 • Comparison of cutting rates in test materials. DRFM is direct filling material

oxide and silicon carbide. The results of this study suggest, however, that there is no particular significance in the kind of material used. It appears that particle size is more important. Those materials having a particle size between 16 and 66 microns, including the standard slurry, seemed to give a much better cutting rate than those having a particle size of 8 microns or less. The two materials having a particle size greater than 66 microns produced a lower cutting rate than the 16 to 66 micron group. This study suggests, then, that there is an optimum particle size for maximum cutting rate. The relation between particle size and the amplitude of cutting tip vibration, however, is not known.

Discussion • This study can be only exploratory because of both the method used and the performance of the instrument during the cutting. The study encompasses at least three variables: (1) abrasive material, (2) particle size and (3) temper of particles. None of these is considered singly for continuous study.

TEMPERATURE RISE IN PULP CHAMBER IN RESPONSE TO CUTTING

One of the foremost problems facing the operator is the control of the heat produced during the cutting of vital tooth structure. A study was initiated to learn to what extent heat is produced by the vibratory method of cutting and how great the problem of its control may be.

Materials and Methods • An opening perpendicular to the long axis of the tooth was made in the lingual surface of each of several recently extracted central incisors. The pulp chamber was filled with water and a thermocouple was placed in the chamber in contact with the labial wall. Cuts were made with the vibratory instrument on the labial surface of the teeth, toward the thermocouple. A 50 per cent powder and water aluminum oxide slurry was used, except in one instance in which no slurry or coolant was used. The rise in temperature in two teeth, as indicated by the thermocouple, was plotted against the cutting time (Fig. 9).

So that the rise in temperature resulting from operation of the instrument when no slurry or coolant was used could be observed, a cut 1 mm. deep was prepared in one tooth on the labial surface and then cleaned and dried. The vibrating cutting tip was placed in it without any slurry or coolant. The rise in temperature was so rapid that after 10 seconds it was too high to be shown on the scale of the recording device, and the operation of the instrument was discontinued.

Results • The initial results indicate that cutting by this method produces heat. In the cuts made with slurry, the rise in temperature was comparatively small for 40 to 50 seconds, after which time the temperature increased more rapidly. After 70 seconds of operation, the temperature rise in both teeth was 20 degrees (F.). In the operation where no slurry was used, the rise was 20 degrees in 10 seconds.

Discussion • The rather sudden rise in temperature after about 50 seconds of cutting might have been due to the approach of the instrument to the thermocouple. Investigation of roentgenograms of the teeth cut showed that the approach was within 1 mm. A maximum temperature rise probably was recorded.

A thermocouple with a larger scale is needed for a more extensive study of the rise in temperature. The very rapid rise during operation without a slurry suggests that the slurry acts as a coolant as well as a cutting agent. The rise in temperature here indicates that the heat generated by this method of cutting is not a serious problem, and that perhaps it

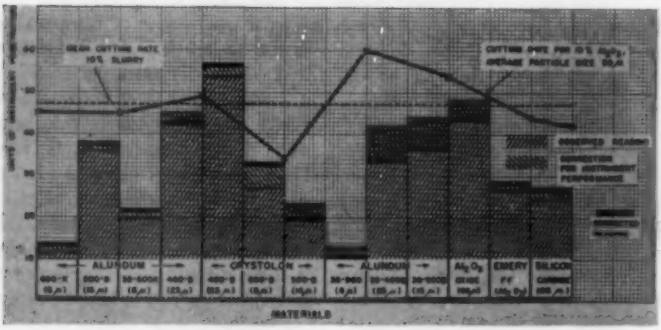

Fig. 8 • Comparative cutting rates of selected abrasive materials, corrected for instrument performance. Particle size is given in microns, and manufacturer's code is listed. Alundum is aluminum oxide; Crystolon is silicon carbide

may be controlled readily through the use of an adequate stream of the abrasive slurry.

GENERAL DISCUSSION

In the biological field, much more work is indicated to obtain adequate information about the effect of this cutting method on vital tissues.

In the physical field, several problems are at once apparent. An instrument with a satisfactory, predictable, reliable cutting rate is needed, questions concerning many unknown factors involved in cutting must be answered and an acceptable contra-angle is necessary, for the experiments described were performed with a straight instrument. It seems clear that any clinical application of this instrument must be deferred until a reliable instrument whose biological effect has been determined scientifically is available.

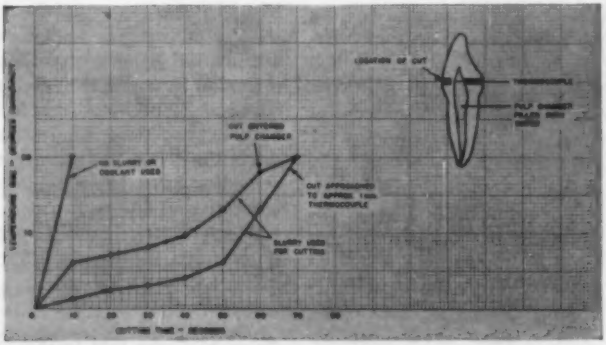

Fig. 9 • Temperature rise in response to cutting

SUMMARY

This report is the second in a series on an investigation into the role of a magnetostrictive device and an abrasive slurry in the cutting of hard structures in operative procedures.

The effect on the cutting rate of the following was studied: (1) pressure, (2) length of use of the instrument, (3) powder: water ratio in the slurry, (4) the material cut and (5) the abrasive material used. The rise of temperature in response to cutting was the subject of a brief study. The results based on these limited studies were inconclusive and were characterized by erratic, unpredictable performance of the instrument. These inquiries indicated the need for much further study to arrive at a just appraisal of the cutting method. The lack of sufficient data on the biological effect of the method of cutting necessitates the deferment of any clinical applications.

Application and revaluation of air abrasive technic

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In the past ten years the dental profession has become increasingly aware of the need for improved methods of cutting tooth structure. Attention has been focused sharply on a number of serious disadvantages in connection with the methods long relied on and on their relation to the stigma of fear and pain which has long been associated with dentistry.

Ultrasonics, air abrasive and the use of diamond-coated rotary instruments at high surface speeds represent radically different approaches to a single fundamental objective—that of a more acceptable, less traumatic method of preparing carious teeth for restoration. Although operative dentistry offers the most practical and reliable means for controlling caries, its benefits have never been accepted fully by the public, largely because of fear and the various degrees of discomfort which are generally associated with visits to the dentist.

Until recently, surprisingly little had been done to analyze, identify and eliminate the basic causes of this condition. By basic causes is meant the fundamental sources of the fear and discomfort that are invariably associated with the use of orthodox instruments, especially the mechanical handpiece. Much effort has been expended to minimize anxiety and discomfort, but for the greater part the remedies have been palliative and not corrective in nature.

Mechanical methods conform adequately to requirements pertaining to

Presented as part of a panel discussion "Newer Devices for Cutting Tooth Structure" before the Sections on Operative Dentistry and Research, ninety-fifth annual session, American Dental Association, Miami, Fla., November 9, 1954.

speed and the strictly geometric considerations relative to cavity forms. It should be borne in mind, however, that dentistry is a biomechanical science. Biological factors are equally as important as speed and mechanical consideration.

BASIC PROBLEM OF OPERATIVE DENTISTRY

Human tooth enamel is a unique substance in that, unlike other materials, it combines an unusual amount of strength and toughness with a high degree of hardness. It is well established that correct preparation of carious teeth for restoration usually necessitates the removal of a substantial bulk of sound enamel and dentin. This is especially true in the treatment of the early stage of lesions. Grooves must be carried out and margins must be extended to relatively immune areas for the prevention of further caries. For stability, retention and resistance to the forces of attrition, the cavity floors must be extended into the dentin.

The hardest and toughest of all human tissues lies in close proximity to extremely delicate and sensitive blood vascular and nervous tissues of the dental pulp. Therefore the real crux of the problem lies in the necessity for excavating these hard structures rapidly and in a manner that complies with recognized geometric requirements of cavity form, but also in a manner which is compatible with biological and emotional considerations relative to the patient.

IDEAL QUALIFICATIONS FOR A DENTAL CUTTING METHOD

A perfect method for excavating human tooth enamel and dentin probably does not exist; however, any intelligent approach to the problem necessitates some thought being given to ideal considerations.

To be considered ideal for dentistry, a cutting method should be:

1. Subject to precise control (for the establishment of the various shapes involved in tooth preparations).
2. Safe (to both dentist and patient).
3. Nontraumatic (not antagonistic to biological and emotional factors).
4. Rapid.
5. Easy to master.
6. Convenient to use.
7. Quiet in operation.
8. Free from fatigue factors (not involving appreciable muscular effort or contributing to nervous tension).

In addition to the foregoing, the ideal cutting method should not necessitate equipment of excessive bulk or expense, and its use should not interfere with normal office routine.

GAS-PROPELLED ABRASIVES

In early 1943, investigations were undertaken to explore the possibilities of a different approach to the problem of preparing cavities for restoration. The primary objective was to find a nonmechanical method that would cut tooth structure rapidly, but with comparative freedom from trauma and discomfort. A further objective was that it be less demanding on the physical and nervous resources of the dentist. These investigations led to experiments with and subsequent application of the principle of kinetics in the form of gas-propelled abrasives.[1]

Reduced to its simplest terms, the air abrasive technic accomplishes its action by the kinetic energy of a high velocity stream of microscopic abrasive particles. Kinetics has to do with the energy of mass in motion. Mathematically, it may

1. Black, R. B. Technic for non-mechanical preparation of cavities and prophylaxis. J.A.D.A. 32:958 Aug. 1945.

be expressed by the formula $E=1/2MV^2$, E representing energy, M mass and V velocity.

More specifically, crystals of aluminum oxide 30 microns in diameter are introduced into a stream of carbon dioxide gas at a pressure of 80 pounds per square inch. This mixture of gas and abrasive is then led through a small hose to a dental handpiece, the contra angle of which terminates in a tiny nozzle of sintered tungsten carbide. The nozzle might be considered the heart of the entire process, for it is here that the aluminum oxide crystals are charged with the necessary energy to accomplish the desired action. They escape from the orifice at a linear velocity of approximately 1,900 feet per second. This is about eight times the surface speed at the periphery of a one-half inch disk rotating at 100,000 rpm. Any area of enamel or dentin against which this stream is directed will be excavated rapidly. If a soft abrasive is substituted for aluminum oxide, the stream will remove rapidly any accumulations of stain or calculus from enamel surfaces.

Fortunately, the action of gas-propelled abrasives is inherently well suited to dental needs. As a method for cutting hard materials, its action is specific. It is extremely effective for penetrating and excavating enamel and dentin, and at the same time it has little effect on soft materials such as the mucosa or the rubber dam. It provides a safer and more rapid method of cutting tooth preparations and complies fully with the established concepts, but in a manner which is more acceptable to the patient and less tiring to the dentist. Furthermore, it provides a rapid, more efficient and less tedious method for removing foreign accumulations from enamel surfaces.

Pulpal stimulation by the action of a gas-driven abrasive, as with the bur and stone, is usually encountered when the pain threshold is low or when the pulp is hyperemic. Although undesirable, it creates no problem because it is always subject to complete control through the use of a local anesthetic.

Because of the absence of any significant heat factor during the action of gas-driven abrasive, it may be employed with greater safety when the patient is under an anesthetic than can the bur or stone.

TOOTH PREPARATION

Rubber Dam • Although not imperative, the use of the rubber dam is strongly recommended. The conditions established through the use of the dam are ideal for the most effective use of the air abrasive and should be considered an essential part of the technic of tooth preparation.

Hand Instruments • Sharp, carbon steel hand instruments are best for the final shaping, trimming and beveling of the tooth preparation that has been established by the air abrasive. In most instances patients tolerate them more readily than they do the rotary instruments.

If the tooth is to be restored by a gold inlay or a jacket crown, rotary instruments are best for the final shaping and finishing.

The typical procedure for air abrasive tooth preparation is as follows:

1. The rubber dam is placed.
2. The patient is placed in the most advantageous position for convenient access and good vision.
3. The air abrasive is used to open up and rough out the preparation, carrying it to semi-finished condition. Greater nozzle distances are used for rapid bulk cutting, and close nozzle distance where precision is required such as in the establishment of margins.
4. Hand instruments are used for the final details and finishing of the preparation.

In contrast to cavity preparation with rotary instruments or ultrasonics in

which cooling with water or water spray is required, the air abrasive method is essentially a dry technic and permits good vision during all phases of the operation. Furthermore, there is no need to change frequently from one shape of instrument to another, inasmuch as the shaping of the cavity is accomplished by manipulation rather than by the use of specially shaped instruments.

Prophylaxis • The basic procedure for prophylaxis with air abrasive is as follows:

1. All sublingual calculus is removed carefully with scaling instruments.
2. A dry field is established with cotton rolls or gauze packs and warm air.
3. Air abrasive is used to remove stain, salivary calculus or combinations of the two from all the exposed surfaces of the crown, but only in areas where foreign deposits are heavy and well attached. In most instances these will be the lingual areas of all the teeth, the labial areas of the lower anterior teeth, the buccal areas of the upper posterior teeth and occlusal surfaces of all the posterior teeth in the mouths of heavy smokers.
4. The mouth is rinsed thoroughly, and the use of the air abrasive is followed by a light application of the rubber cup that carries silex or pumice. This takes only a moment and removes the dolomite from the mucosa and the subgingival areas.
5. When necessary, a high luster may be imparted to enamel surfaces by a brief application of levigated alumina that is carried by the rubber cup.

EVALUATION OF AIR ABRASIVE TECHNIC

The application of kinetics to dentistry results in a number of basic advantages. In the final analysis, however, the real value of any new method lies in its ability to conform to a number of practical considerations that are of paramount importance to the dentist.

To be considered a genuine asset and a sound investment, the advantages of the method must far outweigh the disadvantages. The following conclusions regarding the method have been reached after ten years of clinical experience with the air abrasive technic in some 8,000 operations of various types.

Advantages • The principal advantages of air abrasive are:

1. It provides the most rapid method for excavating tooth enamel. Although the commercial Airdent unit has been adjusted to remove enamel at the rate of 1 mg. per second, this rate may be far exceeded if desired. It has been demonstrated that 30 micron boron carbide grain propelled by helium gas is capable of removing enamel at a rate in excess of 6 mg. per second.
2. It is the most rapid method for the removal of stain accumulations from enamel surfaces.
3. The fatigue factors are largely eliminated since the forces involved in manipulating the air abrasive handpiece are insignificant. Actually they have been found to vary from 8 to 12 Gm., or less than a half ounce. There is no necessity for finger bracing or for holding the patient's head. Likewise, there is no tendency for the instrument to creep, crawl or jump away from the area of operation. For these reasons there is a minimum of physical fatigue and tension.
4. Because of the complete absence of detectable pressure, vibration and heat, there is practically no anxiety or discomfort associated with the operation.
5. It is biologically acceptable since there is an absence of trauma.

It should be emphasized again that the air abrasive method for excavating tooth structure and removing foreign ac-

cumulations is essentially an adjunct and not a substitute. Whereas some operations may be completed entirely with air abrasive, in most instances, whether in tooth preparation or prophylaxis, its use should be supplemented by instrumentation or by the mechanical handpiece or by both.

Disadvantages • The principal disadvantages are:

1. The time and effort required to make the transition from rotary instruments to the air abrasive unit.

2. The size and cost of the present equipment.

3. The tendency of the abrasive particles to abrade ordinary glass mouth mirrors. This disadvantage has been overcome by the use of mouth mirrors in which the usual crystal of glass has been replaced by a similar crystal of water clear synthetic sapphire. These mirrors have been given heavy use for as long as 18 months with no appreciable damage.

Scope of Use • It is conservatively estimated that the air abrasive method is useful in from 70 to 90 per cent of all operative procedures. In connection with specific types of operations in specific regions, the air abrasive is useful in the preparation of Class I, Class II, Class III and Class V cavities for all types of restorations. Its degree of use and effectiveness is influenced by the extent of caries, the existence of previous restorations, access and visibility. Probably its most ideal application is for the treatment of early stages of Class I, II, III and V carious lesions, providing visibility and access are favorable.

Air abrasive is least effective in the treatment of teeth with large open carious lesions or in teeth that contain previous restorations which must be removed.

In connection with prophylaxis, the air abrasive should be restricted to the so-called "heavy" cases in which stains and calculus deposits are thick and well established. It is best suited for this type of operation and in such instances the dentist gains the full benefit of its advantages.

In light cases where the principal need is for the removal of soft deposits and light stain and for the polishing of the enamel surfaces, there is little indication for the use of air abrasive. As a matter of fact, such treatment can be accomplished more rapidly and conveniently with silex or pumice carried by the rotary rubber cup.

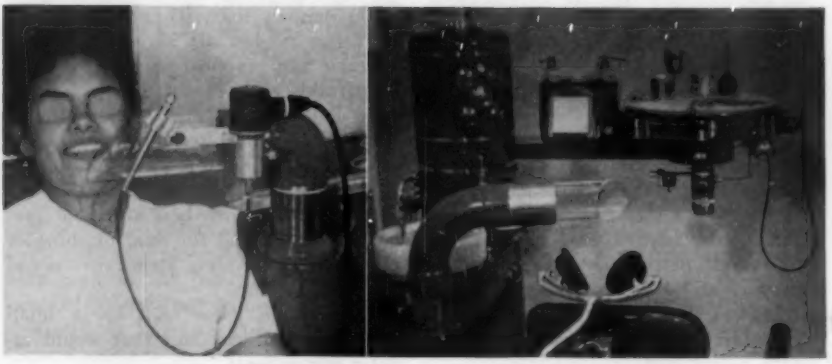
Tooth preparations made with air abrasive and supplemented by hand instruments differ in no essential respect from those made by mechanical methods.

EVALUATION OF THE AIRDENT UNIT

The practicability of any technic, regardless of its advantages, is influenced greatly by the type of equipment offered for its use. Any impartial evaluation of the present Airdent must necessarily be based on its performance and the extent to which it complies with a number of practical considerations that are important to most dentists.

The present Airdent, as a supplementary piece of equipment, is well constructed, nicely finished and has found favor with a number of men, principally those with larger operating rooms where space is not a problem. The feeling has been expressed frequently by others that the machine is too bulky for use in small offices and too large for convenient use in others.[2] Criticism has also been directed to the awkwardness involved in moving it from one operating room to another, the excessive lag in handpiece

2. Epstein, Sidney. Analysis of air abrasive procedures in dental practice. J.A.D.A. 43:578 Nov. 1951.



Left: Small supplementary Airdent unit in position for use. It is self-contained with exception of its source of carbon dioxide which is obtained from conveniently placed wall outlet. Note proximity of electric flow control valve to handpiece which eliminates objectionable lag in handpiece response. Height of arm supporting transparent suction vent for abrasive recovery is controlled hydraulically. Right: Air abrasive elements incorporated into standard dental unit. This method employs use of central source of suction and carbon dioxide located in laboratory which supplies both operating rooms

response to the foot control[3] and the initial cost of this equipment.[4]

For the dentist to gain the full benefit from air abrasive, the equipment should involve a minimum of space, should be convenient to use, and its performance should comply fully with clinical requirements, especially those relative to efficiency of suction apparatus, cutting speed and response of handpiece to foot control. The expense involved should be commensurate with the advantages gained through its use.

Possibility of Smaller, Less Costly Models • Experimental Airdents designed and constructed in Corpus Christi since 1950 have proved the feasibility of small, simplified models that are adequate in performance (illustration).

The first, a greatly simplified supplementary machine, occupies a little over 1 square foot of floor space and is only 36 inches in height. Since it is light in weight, it is easily moved from one office to another.

The second model incorporates highly simplified small air abrasive elements into the bracket table of the standard unit. In this model, the abrasive recovery unit is located in a soundproof cabinet under the laboratory table so as to reduce the sound level in the operating room and to further reduce space requirements. It is connected to a small pedestal-type suction arm located to the left of the chair.

The latter model provides the maximum in simplicity, compactness, convenience and economy. Whereas this model has proved satisfactory for my office arrangements, it is obvious that there are a number of other possibilities relative to the arrangement of the required elements.

There are many who feel that if the air abrasive technic is to receive the recognition and the wide use it deserves, it is essential that the dental profession

3. Taylor, A. R. The Airdent and I. J. New Jersey D. Soc. 23:13 July 1952.

4. Morrison, A., and Berman, L. Evaluation of Airdent unit: preliminary report. J.A.D.A. 46:298 March 1953.

be offered smaller, more convenient machines involving less expense.

CONCLUSIONS

1. Air abrasive provides an easy, rapid and biologically acceptable method for excavating hard tooth structures and for removing heavy deposits of foreign accumulation from enamel surfaces.

2. Tooth preparations completed by means of air abrasive supplemented by mechanical tools for finishing differ in no respect from those established by rotary instruments.

3. The experience acquired by over 2,000 dentists since its introduction in 1951 has proved air abrasive to be a valuable and practical adjunct for tooth preparation and prophylaxis.

4. Evidence indicates that air abrasive is inherently best suited for nontraumatic rapid bulk cutting of tooth structure during cavity preparations. Rotary instruments are inherently best suited for precision shaping and for final finishing of preparations for inlays, jacket crowns and bridge abutments.

5. There is great need for a small convenient Airdent unit that would involve less expense.

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Ultrasonic cavity preparation
II. Progress report

Carl R. Oman, D.D.S., and Edmund Applebaum,† D.D.S., New York*

The use of ultrasonics in dentistry has been reported from many areas both in this country and abroad[1-4] during the past few years. This indicates great interest in this method of cutting teeth. The purpose of this progress report is to describe and interpret some of the effects of ultrasonic cavity preparation on the teeth of human patients and experimental animals.

MATERIALS AND METHODS

The ultrasonic mechanism[5] consists of a variable frequency (electron-tube) oscillator which feeds a high-frequency alternating current to the magnetostrictive handpiece through a power amplifier. At the same time, D.C. polarizing current is fed to the magnetostrictive handpiece so that the vibration of the hand-

Presented as part of a panel discussion "Newer Devices for Cutting Tooth Structure" before the Sections on Operative Dentistry and Research, ninety-fifth annual session, American Dental Association, Miami, Fla., November 9, 1954.

Equipment loaned by the Cavitron Equipment Corporation.

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†Associate professor of dental anatomy, Columbia University School of Dental and Oral Surgery of the Faculty of Medicine.

1. Manly, R. S., and Brudevold, F. Tests on applicability of high frequency vibrations for dental operations. D. Items Interest 71:134 Feb. 1949.

2. News of dentistry. J.A.D.A. 49:250 Aug. 1954.

3. Leatherman, G. H. News from Great Britain. J.A.D.A. 49:112b July 1954.

4. Oman, C. R., and Applebaum, E. Ultrasonic cavity preparation. Preliminary report. New York D. J. 20:256 July 1954.

5. U.S. Patent no. 2,580,716 granted Jan. 1, 1952.

piece follows the frequency of the alternating current. In this ultrasonic dental apparatus, the handpiece houses a magnetostrictive element which vibrates at 30,000 times per second. It is the rapid vibratory motion of the element that in turn produces the vibration of the dental tool which in turn transmits efficient cutting action to the abrasive liquid mixture that is in contact with the tooth.

To date, the ultrasonic handpiece has been used in the treatment of 40 patients of different age and sex. The cavity preparations have ranged from simple Class I cavities on occlusal surfaces to gingival cavities and standard Class II preparations that were to be filled with amalgam or gold inlays. One porcelain jacket preparation has been clinically completed for an adult in which only the ultrasonic tool was used. In addition, regulation cavities have been cut in teeth that young patients were subsequently to lose as a part of orthodontic treatment. Several condemned teeth that were scheduled for extraction were prepared for patients prior to prosthetic treatment.

The ultrasonic handpiece was used for cavity preparation in two teeth of a chimpanzee and another tooth was prepared using a conventional bur; still another tooth was kept as a control. The chimpanzee, which was being used primarily for experimental brain surgery, was about ten years old. According to Schultz[6] this age for a chimpanzee is comparable to approximately twice that age in a human being. The third molars of this chimpanzee had erupted and there was considerable wear on all the other teeth.

The ultrasonic handpiece was used in the preparation of four cavities in the teeth of a young dog. A dental bur was used to prepare a cavity in this dog's lower left cuspid, and another cavity was prepared in its lower left lateral incisor using the air abrasive technic. The lower right lateral incisor was used as a control. All of the cavities were filled with zinc oxyphosphate cement. The dog was sacrificed two weeks after the initial cavity preparation.

Recently three young rhesus monkeys were obtained in which the complete deciduous dentitions were well worn. One of the monkeys had recently erupted a permanent upper central incisor. Twelve teeth were prepared using conventional burs and 15 were prepared with the ultrasonic handpiece. The cavities were comparable in depth. All cavities were filled with zinc oxyphosphate cement. The animals were sacrificed two weeks after the first cavity preparation.

OBSERVATIONS

In the beginning, interest was centered in the possibility of cutting human teeth efficiently with the ultrasonic device. This had been demonstrated by the preliminary attempts in which the industrial device was used on extracted teeth. The smoothness of the cuts plus the accuracy attained was a stimulus to continued effort. The next step was the development of a dental unit which could be used for the cutting of laboratory specimens as well as for work in the mouth. The handpiece evolved from a rather cumbersome beginning to its present convenient form. At the outset it was not known that the reaction of patients would be as favorable as it is, especially when the operations were to be performed on the immature teeth of children.

The annoyance caused by the vibration that results from the moving parts of a conventional rotating drill was practically absent. Patients reported that virtually no pain was felt, even when dentin was being cut with the ultrasonic handpiece. Only three or four of the patients reported pain, and that seemed to occur

6. Schultz, A. H. Eruption and decay of permanent teeth in primates. Am. J. Phys. Anthropol. 19:489 Jan.-March 1935.

at the time of penetration of the dentoenamel junction. Further penetration into the dentin was painless, and the cavities were completed in comfort. In four instances extreme pain was experienced when the tool was removed and an explorer drawn over the surface of the dentin. On re-introducing the ultrasonic tool with a liberal slurry of abrasive and water, further cutting proceeded painlessly. It was found, however, that very soft carious material had to be removed with an excavator or with a conventional round bur. Ordinary leathery decay such as is found in routine cavity preparation is easily and effectively removed in the process of cutting the cavity.

Up to the present time, no subjective or clinical reactions have been noted in patients that might indicate degenerative changes in the pulps of treated teeth. Close cooperation will be needed, however, between practitioner and pathologist in order to determine what happens after cavity preparation with the ultrasonic cutting tool.

The primary purpose of these preliminary experiments was to find out whether the ultrasonic method of cavity preparation *per se* caused any changes in the pulp that were drastically different from those produced by the conventional bur. The answer in simplest terms is that, under the conditions of these experiments, the inflammatory changes in the pulps of teeth treated by the ultrasonic handpiece were about the same as those in teeth treated with the conventional bur when the cavities in both were filled with cement. Of course, the problem is more complex than is indicated in that simple statement, and more definitive work remains to be done.

DISCUSSION

Previous studies have showed that several important variables must be considered in the interpretation of the effects of operative procedures on the tooth pulps in clinical patients and in experimental animals. Fish[7] in 1932 reported the results of eight years of animal experimentation. He stated that the amount of reaction in the pulp seems to depend on the experimental conditions. These conditions included the depth of the cavity and the amount of frictional heat produced by the bur. It also depended on whether the cavity was filled or left open to the fluids of the mouth.

Fish's study indicated that external irritation reduced the permeability of the dentin through the formation of a translucent zone. He also described a dead tract of tubules under caries and claimed it is more common than the translucent zone. The finding of a translucent zone in dentin under caries goes back over 100 years to the classic observations of Sir John Tomes.[8] Certainly fillings placed in previously carious cavities exert comparatively little influence on the pulp which protects itself by the development of translucent dentin or secondary dentin.[9] Pulps of teeth free from caries and abrasion usually are large and free from changes common to worn or carious teeth.

Manley[10] operated on young dogs, inserting a rubber dam prior to the preparation of the cavity. He used a slow-motion handpiece, the full power of the engine being transmitted to a slowly revolving bur. Through this method overheating of the dentin by the bur was avoided. Manley waited 10 to 12 weeks after the cavity was prepared and filled before the dog was sacrificed and the tooth studied. Manley emphasized the variable reaction

7. Fish, E. W. An experimental investigation of enamel, dentine, and the dental pulp. London, John Bale Sons & Danielsson, 1933.

8. Tomes, John. A course of lectures on dental physiology and surgery. London, John W. Parker, 1848, p. 203.

9. Bodecker, C. F., and Applebaum, E. The variable permeability of the dentin and its relation to operative dentistry. D. Cosmos 74:1171 Dec. 1932.

10. Manley, E. B. A preliminary investigation into the reaction of the pulp to various filling materials. Brit. D. J. 60:321 April 1936.

of the pulp to different filling materials and emphasized the severe reaction to cements. Zander[11] showed severe pulp damage caused by silicate cement restorations, while Lefkowitz, Seelig and Zachinsky[12] stated that there was no pulp response to a self-curing acrylic material.

Gurley and Van Huysen[13] concluded from their experimental work on the teeth of young dogs that:

> 1. Filling of cavities with the cements or temporary stopping is followed by changes in the underlying pulp and dentin histology.
>
> 2. Destructive changes are evident when the cavity and fillings lie close to the pulp. . . .

In general, the area of injury to the pulp is bounded by the extent of the cut dentinal tubules. In instances of mild irritation, only the odontoblasts are affected. When trauma is extreme, the region of degeneration extends into the stroma of the pulp. Large vacuoles or localized abscesses may appear and capillary hemorrhage may occur.

In the present study, a few young and mature animals have been used. The cavities were shallow and the zinc oxyphosphate cement fillings were in place for one to two weeks. Other conditions or combinations of conditions and their effects on tooth pulps must be studied; for example, it will be necessary to allow a longer time to elapse before sacrificing the experimental animals. Obviously, the effect of the ultrasonic procedure on human pulps will be of great interest. Cavities have been prepared in the upper bicuspids of several young patients who, for orthodontic reasons, are to have these teeth extracted. The results will be reported later.

In work on patients, the clinical results have been favorable, even in young persons with presumably permeable dentin and large pulps. Ultrasonic cavity preparation would seem to be a boon to the dentist because the hazard of a restless and apprehensive patient is minimized. This is particularly important with young patients in their first contact with a dentist.

Prefabricated inlays are a possibility[14] but it is not felt that this technic would be in the best interests of the patient. It is better that instrument design be confined to the type of cutter which can cut a box quickly and accurately. Each dentist, however, can design and fabricate the required tools quickly. There need be no sacrificing of ideals when the ultrasonic technic is employed.

SUMMARY

The ultrasonic method for cutting the hard dental tissues has been studied. A magnetostrictive handpiece, vibrating at ultrasonic speed, is used in conjunction with an abrasive mixture in the preparation of cavities. The method permits accurate smooth cuts on enamel or dentin. The ordinary leathery carious material found in routine cavity preparation is removed easily and effectively in the process of cutting the cavity. Favorable clinical results were secured with 40 patients who ranged in age from 12 years to 70 years.

Histologic studies of prepared teeth of experimental animals have indicated that there was pulp inflammation whether treatment was by ultrasonic or conventional bur. Further definitive studies are necessary before this new technic of cavity preparation can be put into general use. Such studies are now under way at Columbia University School of Dental and Oral Surgery as well as in other dental schools.

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Hyaluronidase for prevention of edema after removal of impacted mandibular third molars

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The value of hyaluronidase in aiding diffusion and consequent resorption of local fluid accumulations caused by operative or other traumas has been definitely established.[1-11]

Since the discovery by Duran-Reynals[12, 13] of a spreading factor in extracts of rodent testes, the chemical properties and pharmacologic action of this substance, later named hyaluronidase by Meyer, have been extensively studied.[14-22] Now recognized as one of a group of enzymes which depolymerize hyaluronic acid, the ground substance of animal tissues, hyaluronidase acts by temporarily breaking down interstitial barriers, permitting wider, more rapid diffusion and facilitating resorption of extracellular fluids. The natural hyaluronic acid barrier is partly restored in 24 hours and completely restored in 48 hours.[18]

Most laboratory and clinical studies of hyaluronidase in dispersion of traumatic transudates have been concerned primarily with therapeutic application of the enzyme to reduce established swelling and to relieve induration. There are few reports of controlled clinical data concerning the effectiveness of hyaluronidase for prevention of the swelling that inevitably follows mechanical trauma in dental surgery.

Devine[23] first described the use of hyaluronidase for prophylaxis of traumatic edema in two patients operated on for impacted mandibular molars. To prevent the severe swelling that ordinarily follows such a procedure, he injected 150 TRU hyaluronidase into the mandibular

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foramen immediately after administration of a local anesthetic. A TRU (turbidity-reducing unit) is defined as the amount of hyaluronidase which will reduce the turbidity produced by 0.2 mg. of potassium hyaluronate in acidified horse serum to that produced by 0.1 mg. under assay conditions. Devine stated that postoperative pain, edema and disability were prevented in each instance. There were, however, no controls.

Fleuchaus[24] reported a controlled clinical study in which hyaluronidase was dissolved in a local anesthetic agent in order to prevent traumatic swelling in 19 patients operated on for bilateral mandibular third molar impaction. Measurements were taken of the thickness of the cheek and the width of the mouth opening before the anesthetic was administered, and the measurements were repeated daily for five days after the operation. One side of the jaw in each patient was the site of the prophylactic procedure; the other side was used for the control. Sixty TRU hyaluronidase were administered in most instances. Fleuchaus stated that swelling and trismus were definitely reduced after the prophylactic procedure and suggested that use of a larger dose of hyaluronidase might have improved the results.

Hyaluronidase has been administered to conscious patients in dental operations[25, 26] and other surgical procedures [1-11, 27, 28] where local anesthetics have been employed, and the injection has been found to be no more painful than the injection of antibiotics.

PROCEDURE

The investigation reported here was carried out with 51 patients seen in private practice who were suffering from bilateral impacted mandibular third molars. Since some individuals experience more reaction than others to the same degree of trauma, the study took into account this variation from patient to patient, and thus insured as fair a trial as possible of the prophylactic procedure. In each instance, therefore, one side of the jaw was injected with the enzyme, and the other side was not. By this method the results of the experimental procedure could be compared with those of the control procedure in the same individual.

The patients were classified initially according to the severity of the surgical insult to be expected on each side of the jaw, as indicated by preoperative roentgenograms. Patients in whom it appeared that the amount of trauma would be approximately the same in both operations were placed in one group, and the injection was alternated from left to right sides. Twenty-two patients comprised this group. Those patients in whom impaction was more serious on one side than the other, or in whom greater difficulties would be encountered or a longer time required during one operation than

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Table • Number of instances and degree of swelling on first postoperative day

	Degree of swelling on injected side				Degree of swelling on uninjected side			
	None	Slight	Moderate	Severe	None	Slight	Moderate	Severe
Surgical trauma on both sides equal; hyaluronidase injected on one side (22 patients)	12	10	0	0	0	3	10	9
Surgical trauma greater on one side; hyaluronidase injected on side of greater trauma (22 patients)	7	12	3	0	0	7	14	1
Surgical trauma greater on one side; hyaluronidase injected into side of lesser trauma (7 patients)	7	0	0	0	0	2	2	3
Total operations	26	22	3	0	0	12	26	13
Per cent of operations	51	43	6	0	0	24	51	25

the other were placed in a separate group. Twenty-nine patients were placed in this category. Of this latter group, 22 patients received hyaluronidase on the side of the jaw which would be subjected to greater surgical stress, and seven patients received the injection on the side which would be less severely traumatized.

TECHNIC

The hyaluronidase solution was prepared as follows: For each prophylactic treatment 1.5 cc. normal saline solution was placed in a 2 cc. Luer-Lok syringe fitted with a 1 inch 22 gauge needle. The needle was introduced into a vial containing 150 TRU Wydase,[29] and 0.5 cc. of the solvent was injected into the vial. Since the lyophilized preparation is readily soluble in saline solution, the material dissolved promptly and the solution could be withdrawn into the syringe almost at once. The dose was then ready for immediate use.

The impacted tooth was removed under general anesthesia, and immediately 150 TRU hyaluronidase (1.5 cc. solution) was injected anteriorly into the border of the masseter muscle, near the site of its attachment to the mandible.

Hyaluronidase has no propulsive properties. Rapid diffusion occurs only if local interstitial pressure is increased mechanically. The rate of diffusion is proportionate to the amount of the enzyme administered, and the extent is proportionate to the volume of the fluid injected.[25, 26] In order to provide internal pressure for dispersion of the dose over a sufficiently wide area in the submaxillary and submandibular regions, the solution was expelled from the syringe with considerable force. External application of pressure, as by a compress held or bandaged firmly against the treated cheek, might have increased diffusion of the hyaluronidase solution.

Each patient was examined on the day after the operation and again five to seven days later.

RESULTS AND DISCUSSION

The number of instances in which there were varying degrees of swelling on the injected and uninjected side of the jaw in the 51 patients operated on is shown in the table.

Only in one instance was the condition on the treated side of the face the same as on the control side, and the amount of traumatic edema was slight after both operations. None of the experimental

29. Wydase (N.N.R.), lyophilized hyaluronidase, was supplied through the courtesy of Wyeth Laboratories, Philadelphia.

operations was followed by severe swelling. As a result of the control operation, however, all patients experienced swelling.

Almost from the start of postoperative management, the contrast between the results of the prophylactic treatment and those of the control operation provoked embarrassing questions from the patients. Many of them insistently inquired why one side of the face was swollen and painful and the jaw stiff, whereas the other side was relatively normal. Most of the patients stated that only the swollen cheek, which in all instances was on the control side, was painful, or that there was more soreness in this cheek than in the other. On the side of the jaw which did not receive an injection, there was always trismus, which persisted until the edema had subsided.

At the second examination it was found that all the patients had recovered from the malaise to be expected after such an operation, and little if any swelling could be detected.

The age and sex of the patients had no apparent influence on the results of prophylaxis. The use of hyaluronidase did not alter the incidence of septic alveoli.

Since the completion of this study, a series of patients suffering from bilateral impaction of mandibular third molars has received hyaluronidase in the same dose and administered by the same method, but on both sides of the jaw. In all instances, little or no swelling, pain or stiffness has followed the operation.

No localized or generalized side effects have developed after the administration of hyaluronidase. The experience of the authors, who have given more than 200 injections up to the present time, corroborates the extensive toxicity studies of others,[22] indicating that this preparation in therapeutic doses is completely nontoxic. The ratio of toxic dose to therapeutic dose is about 200,000 to 1.[22]

The use of hyaluronidase, therefore, to prevent traumatic swelling after dental operations has been adopted as a routine procedure in the authors' practice.

SUMMARY

The value of hyaluronidase for prevention of traumatic swelling was studied in 51 patients operated on for bilateral impaction of mandibular third molars.

The teeth were removed under general anesthesia, and hyaluronidase, in doses of 1.5 cc. dissolved in sterile normal saline solution, was immediately injected near the masseter muscle. One side of the jaw was used for the prophylactic treatment and the other side for the control operation in each patient.

In 22 patients, trauma was about the same on both sides; therefore, injections were alternated from left to right sides. Of the 29 in whom operation on one side presented greater difficulties or required a longer time than on the other, 22 received the injection on the side subjected to greater trauma, and seven patients on the side less severely traumatized.

On the first postoperative day no swelling was present on the treated side of the jaw in 51 per cent of the patients, slight swelling was present in 43 per cent and moderate swelling in 6 per cent. After the control operations, all patients had swelling. Edema was severe in 25 per cent, moderate in 51 per cent and slight in 24 per cent. No localized or generalized side effects developed. The hyaluronidase solution was found to be completely nontoxic in more than 200 injections.

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Transfer to teeth of topically applied, carbon^{14}-tagged sodium oxalate

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Several reports in the literature indicate that the solubility of enamel in acids can be changed by the action of various ions. Silver,[1,2] lead,[3] fluoride,[4,5] and oxalate[3,6] are examples of various ions reported to have this property.

Gortner and others[7] reported that the presence of oxalic acid or its sodium salt when added to the food or drink of rats prevented or diminished a characteristic decalcification of teeth which accompanies the ingestion of phosphoric and citric acid solutions. He also reported that natural oxalate-containing foods, such as spinach and rhubarb, produced protective films on rat molars within one week. McCay and Will,[8] as a result of their studies on the erosion of molar teeth by acid beverages, concluded that sodium oxalate dissolved in an acid beverage prevents tooth erosion. Twedt and Cajori[9] reported that sodium oxalate at a level of 0.5 per cent, when incorporated in a cariogenic diet, protected the hamster from caries. Chemical analyses of the tooth substance revealed that significant amounts of oxalate had been incorporated into the teeth.

It appears, therefore, that the action of oxalates on tooth enamel parallels that of fluorides. The work reported by Myers, Hamilton and Becks[10] on the transfer of fluorine[18] to teeth stimulated the present study in which C^{14}-labeled sodium oxalate was used.

METHOD AND MATERIAL

Approximately one millicurie of 1,2-C^{14}-labeled oxalic acid was obtained from Oak Ridge National Laboratories and converted to sodium oxalate with sodium

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hydroxide. By successive volumetric dilutions a sodium oxalate solution containing 6.1 micrograms per milliliter was prepared, 0.1 milliliter of which was deposited on a watch glass to make a reference source of 0.61 micrograms of sodium oxalate or about 0.01 microcurie of C^{14}. This reference source was used for comparison in estimating the amount of oxalate transferred to the teeth. Counting rate measurements were taken with an RCL Mark I Model 5 end-window beta counter (window thickness 1.9 mg. per square centimeter) operating into an NRD Model S-1001 scaler. The reference source with a disintegration rate of about 370 betas per second produced 36 counts per second in the Geiger counter.

Radioautographs were taken to demonstrate the location and penetration of the oxalate in the tooth structures. The testing procedures for the various teeth differed in some respects, but in general they involved treating the lower tips of the teeth with oxalate, then rinsing, scrubbing or simply drying the teeth, sectioning them and making radioautographs. The sectioning was accomplished by making one cut either crosswise or lengthwise with a saw and then smoothing one interface by grinding it on successively finer stones. Superla oil was used as a lubricant to avoid dissolving and spreading the oxalate deposit. The oil was removed by rinsing the section in xylene. Since the C^{14} betas have a range of less than 100 microns in enamel, the section does not have to be thin to obtain a good picture of the distribution of oxalate over the interface. The radioautographs were obtained on Eastman Kodak medium lantern slides. The sections were pressed gently into direct contact with the emulsion side of the plates and left

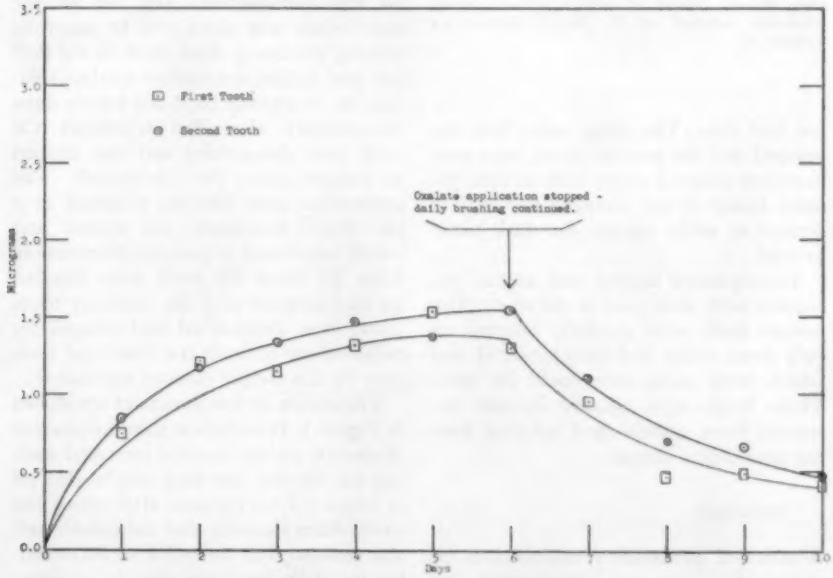

Fig. 1 • In vitro *absorption of radioactive oxalate from solution*

Fig. 2 • Extracted human tooth after daily exposure to C^{14}-labeled sodium oxalate solution. Heavy deposit of sodium oxalate, at A, probably entered at B. Small deposit on enamel, C

for four days. The plates were then developed and the positive prints were produced on contrast paper with an enlargement factor of ten, showing the oxalate deposit as white against the dark background.

Twenty-seven human and animal extracted teeth were used in the study. The human teeth were carefully selected, as only those which had intact enamel and which were caries free could be used. These teeth were usually incisors extracted from middle-aged subjects having periodontal disease.

FINDINGS

A series of preliminary experiments on extracted animal and human teeth was run to show the location and amount of oxalate deposit obtained with various soaking procedures. When a freshly extracted human tooth was soaked for one hour in 0.6 per cent C^{14}-labeled sodium oxalate solution, rinsed and sectioned crosswise, there was a localized deposit and some deposition in very fine cracks. This result was similar to the results of other soaking tests, which indicated that the oxalate is deposited on areas of the tooth where some imperfections exist, such as stains, pits, lamellae and fine cracks in the enamel.

The rate of the transfer of sodium oxalate from a mouthwash and a dentifrice, which might occur in the daily use of these substances, was measured by topical application to freshly extracted human teeth.

The mouthwash was simulated by making a water solution containing 0.25 per cent radioactive sodium oxalate by weight. Two adult human incisors were rinsed and thoroughly brushed with an ordinary tooth paste, then rinsed in water and damp-dried. The use of the mouthwash was simulated by carefully soaking the tips of these teeth in the 0.25 per cent radioactive sodium oxalate solution for 30 seconds each day for six days. Immediately after this treatment the teeth were damp-dried and then dipped in human saliva for 30 seconds. The teeth were then allowed to stand in a jar which contained wet cotton and which was closed to prevent evaporation. After 24 hours the teeth were brushed for two minutes with the ordinary tooth paste, then damp-dried and assayed for radioactivity on both the front and back sides by the Geiger counter method.

The results of this treatment are shown in Figure 1. It is obvious that the amount of oxalate on the surface increased each day for the first few days and leveled off at about 1.5 micrograms after about one week. After the sixth day the mouthwash was omitted, but the other steps, including the daily brushing with the ordinary dentifrice, were continued. The surface

deposit of oxalate was reduced each day for about a week, after which there remained an apparently permanent deposit of about 0.5 micrograms. The amount deposited on the entire crown of the teeth was included in this measurement.

A radioautograph was made after the mouthwash experiment to show the location of deposits of oxalate (Fig. 2).

The tooth brushing studies were conducted in a similar manner. The dentifrice was prepared by adding 0.015 Gm. of radioactive sodium oxalate in 2.5 Gm. of water to 1 Gm. of ordinary dentifrice. Ratio of oxalate to total weight was 0.43 per cent. Two freshly-extracted human incisors were thoroughly cleaned as described previously, and then brushed for two minutes with the radioactive tooth paste, rinsed in water and damp-dried. They were dipped in a sample of human saliva for 30 seconds and allowed to stand in a closed jar as described previously. After standing for 24 hours, the teeth were rinsed and assayed for radioactivity on the front and back sides.

The results of these brushing experiments are shown in Figure 3. The amount of oxalate on the tooth surface appeared to increase each day until a maximum of 2 to 3.5 micrograms of oxalate was reached. After the fourth day the radioactive tooth paste was replaced by an ordinary paste and the treatment continued. The surface deposit of oxalate was reduced each day for about a week, after which time there remained an apparently permanent deposit of about 0.5 micrograms. The permanent deposits of the four teeth were remarkably equal.

The radioautographs of the tooth used in the tooth paste study is shown in Figure 4. There is a concentrated deposit

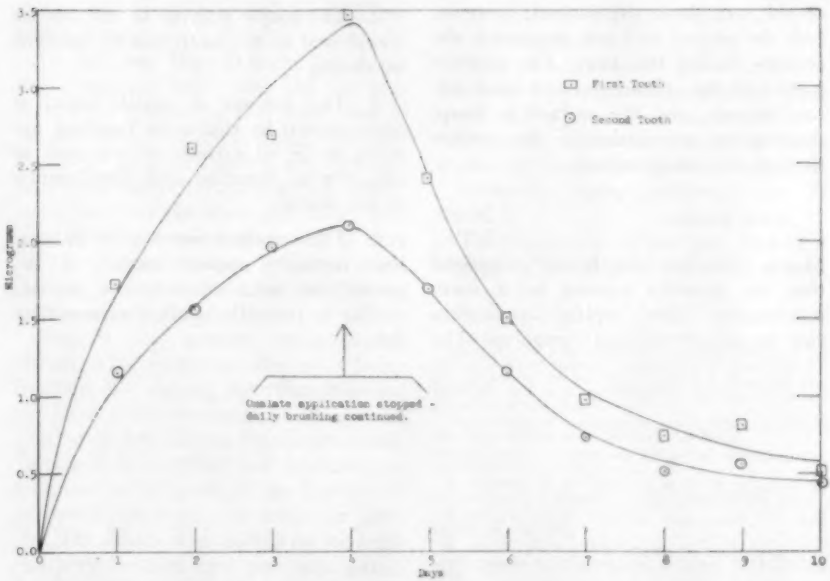

Fig. 3 • In vitro *absorption of radioactive oxalate from dentifrice*

Fig. 4 • Extracted human tooth after daily brushing with dentifrice containing C^{14}-labeled sodium oxalate. Concentrated deposit at A; small diffuse deposit at B

on the root above the enamel; however, only the enamel area was exposed to the counter during the assay. The exterior surface of the enamel shows a small diffuse deposit, and the surface is sharp, showing no penetration of the oxalate through the intact surface.

DISCUSSION

Myers, Hamilton and Becks[10] suggested that the fluorides present on a tooth immediately after topical application can be divided in two categories. The first of these is composed of the fluorides on the intact surface of the enamel which can be removed readily by rinsing with water. The other fluorides are retained in the surface defects of the enamel and are not removed by washing.

The results reported here on radioactive sodium oxalate appear to parallel those on radioactive fluoride. There is a small permanent deposit of oxalate in all of the minor surface cracks and discolorations. The results indicate that oxalate can be transferred from a dentifrice to tooth enamel by daily brushing.

SUMMARY

1. It has been demonstrated, by means of *in vitro* study of topical application of solutions and a dentifrice containing radioactive oxalate, that a small amount of ionized oxalate can be permanently deposited on tooth enamel.

2. The major portion of the oxalate transferred to the tooth can be removed by rinsing.

3. The amount of oxalate which is not removed by rinsing or brushing appears to be in surface defects such as pits, cracks, lamellae and discoloration of the enamel.

4. These radioactive studies indicate that topically applied oxalate is deposited on tooth enamel in a manner similar to topically applied sodium fluoride.

Classics • The classics are only primitive literature. They belong to the same class as primitive machinery and primitive music and primitive medicine. ***Stephen Leacock, "Homer and Humbug."***

Lysine deficiency and dental structures

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Relatively few data are available about the relation of amino acid deficiencies and oral disease, although a fair amount of literature has accumulated concerning the effects of protein deprivation on the oral structures. The literature about the consequences of the lack of a single indispensable amino acid on such structures, however, is rather meager. The possible existence of subclinical lysine deficiencies is not too remote. The deficiency of lysine in some of the cereal grains was noted in the earliest determinations of their basic amino acid content as well as their nutritive value.

In 1914 and 1915 Osborne and Mendel[1, 2] reported that young rats fed artificial diets containing zein from corn as the sole source of protein rapidly declined in weight and died unless the diet was supplemented with tryptophan and lysine. In spite of all the time and effort that have been expended since 1914, very little precise information is now at hand showing any specific role for lysine in the mechanisms of growth.

Few, if any, specific symptoms are known to follow the withdrawal of lysine from the diet. Among the effects reported by Harris and co-workers[3, 4] are a general wasting of soft tissues, hypoproteinemia, decreased hemoglobin and erythrocytes, decreased calcification of the bones with narrowed epiphyses and testicular atrophy. The effects of such diets on the teeth and periodontium were not investigated. It is important to note that these investigators used older animals weighing 110 to 140 Gm. Any effects of amino acid deficiency which are related to the dental structures, obviously, are most likely to have greater influence in younger animals.

MATERIALS AND METHODS

The experimental animals used were of the University of Southern California strain. The animals were placed on a standard Purina diet for one week immediately after weaning. They were then divided into four experimental groups of ten females each:

Group 1. Controls.

Group 2. Lysine deficiency for three weeks and repleted for four weeks.

Group 3. Lysine deficiency for seven weeks and repletion for four weeks.

Group 4. Lysine deficiency for 11 weeks.

The composition of the basal diets used is given in the table. At the end of each

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Table • Diet for experimental and control animals in Gm.

	Experimental animals	Control animals
Zein	19.2	18.0
l—* Arginine	1.0	1.0
l—Histidine	0.5	0.5
l—Tryptophan	0.25	0.25
l—Lysine	0.0	1.2
l—Cystine	0.25	0.25
dl—† Methionine	0.60	0.60
dl—Phenylalanine	0.70	0.70
dl—Threonine	1.20	1.20
dl—Valine	1.6	1.6
Basal diet§	100	100

*levo-
†dextro-levo
§Cornstarch, 1,100 Gm.; cellulose, 100 Gm.; USP salt mixture no. 2, 80 Gm.; cod liver oil, 65 Gm.; wheat germ oil, 65 Gm.; lard, 80 Gm.; choline hydrochloric acid, 4.2 Gm.; calcium pantothenate, 0.08 Gm.; inositol, 0.5 Gm.; nicotinic acid, 0.1 Gm.; thiamine, 0.08 Gm.; riboflavin, 1.07 Gm.; pyridoxine, 0.03 Gm.; aminobenzoic acid, 0.5 Gm.; biotin, 0.005 Gm.; folic acid, 0.005 Gm.; vitamin B_{12}, 10 micrograms; crude liver extract, 2 ml.

experimental period the animals were killed. The jaws and left femurs were dissected out, fixed in Bouin's fluid and prepared for sectioning by standard technics.

OBSERVATIONS

The growth effects on the various experimental groups is given in Figure 1. The animals on the lysine deficient diet were smaller than the controls in all instances. The evidence seems fairly clear that because of the operation of the law of the minimum, tissues synthesis comes largely to a standstill when lysine is lacking from the diet. These findings bear the practical implication that a dietary deficiency in one amino acid, because of the effects of the imbalance, may produce a greater clinical effect than a low protein diet.

Long Bones • The proximal head of the tibia of the control animals is shown in Figure 2, #1. The epiphyseal plate can be divided into four definite zones. The first and external region adjacent to the bony trabeculae of the epiphysis consists of immature chondrocytes of moderate size which are scattered throughout the intercellular matrix. Below this region, the area is composed of young proliferating cartilage cells arranged in columns paralleling the long axis of the bone. The third layer contains cartilage cells that are maturing as characterized by their enlargement, as well as by their glycogen-filled cytoplasm. The internal layer, adjacent to the diaphysis, consists of a narrow band of cells which are in various stages of degeneration or are necrotic. The matrix is calcified and undergoing bony replacement. The trabeculae of the epiphysis are wide and anastomose with each other. The diaphysis, on the other hand, contains narrow, longitudinally disposed bony trabeculae with cartilaginous cores. Capillaries and hematopoietic tissue fill the marrow spaces in both the epiphysis and diaphysis.

In the animals fed the diet deficient in lysine for three weeks, the head of the tibia showed degenerative lesions. A narrowing of the epiphyseal plate resulted from the failure of the proliferating layer

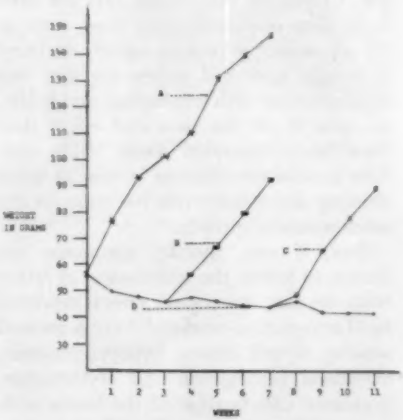


Fig. 1 • Growth curves of animals. A: Control animals. B: Animals on diet deficient in lysine three weeks, then with lysine added four weeks. C: Animals on diet deficient in lysine seven weeks, replete with lysine four weeks. D: Animals on diet deficient in lysine 11 weeks

to mature, degenerate or calcify. The medulla of both the epiphysis and diaphysis showed signs of beginning osteoporosis. These degenerative lesions were considerably aggravated as the deficiency was continued for seven weeks (Fig. 2, #2). The epiphyseal plate became markedly narrowed and very irregular in outline. The zone of resting cells appeared unaffected, but the proliferating cells became flattened and decreased in number.

Effect of Repletion • When the experimental animals three and seven weeks on a deficient diet were fed a lysine-supplemented diet, reversibility of the lesions was noted. Figure 2, #3 represents a section from an animal on a diet deficient in lysine three weeks and then on a diet supplemented with lysine for four weeks. Resumption of chondrogenesis and osteogenesis is noted in the reappearance of the characteristic four layers of the epiphyseal plate. The trabeculae of both the epiphysis and diaphysis are wider and increased in number. Repletion of lysine even after seven weeks of deficiency was followed by a restoration of chondrogenic activity at what appears to be an accelerated rate (Fig. 2, #4). This acceleration in the growth rate of the epiphyseal plate is evident by its increased width, whereas increased osteogenesis is evident by the return of thick trabeculae lined by osteoid material and osteoblasts.

Mandibular Condyle • A section of the mandibular condyle from the control animals demonstrates the existence of three distinct regions (Fig. 3, #5): (1) a layer of dense connective tissue; (2) an intermediate zone, a transitory area of immature resting cartilage cells and (3) an inner region composed of both proliferating and maturing cells. The subchondral area is filled with bony trabeculae and myeloid tissue. The effect of lysine deficiency upon the condyle is seen in Figure 3, #6. The superficial layer is unaffected while there is marked narrowing of the cartilage layers. The transitory layer consists of five to six cells in thickness, and the proliferating chondrocytes have decreased in number so that the layer is now only two to three cells thick. There is a marked absence of trabeculae in the subchondral region. Chondrogenesis and osteogenesis are resumed after lysine is returned to the diet.

Alveolar Bone • The alveolar bone of the molar teeth of the control animals consists of two layers, as viewed in a mesiodistal section (Fig. 4, #7). The alveolar bone proper (cribriform plate) is made up of both lamellated and bundle bone, which immediately surrounds the roots of the teeth and gives attachment to the principal fibers of the periodontal membrane. The inner portion, the substantia spongiosa, is characterized by being dense with thick trabeculae and small narrow spaces that are filled with myeloid elements.

Changes are noticed in the interradicular and septal bones in animals on a deficient diet for three weeks. The alveolar bone proper at this time appears unaffected, whereas the substantia spongiosa shows initial signs of bone loss. At seven weeks progressive degenerative changes are noticed (Fig. 4, #8). At this time fragmentation of the cribriform plate is beginning in both the interradicular and the septal regions. Concomitant with this bone loss is disorganization of the attachment fibers. The osteoporosis of alveolar bone proper remains.

In the interradicular region, with a continuation of bone loss, fragmentation of the bone results (Fig. 5, #9) with a complete loss of attachment fibers. The marrow spaces and periodontal membrane are now filled with fibrous tissue.

Effect of Repletion • During the process of repletion the extreme osteoporosis disappears and the reparative osteogenic process is taking place. Figure 5, #10, is a section from a repleted animal in which

the periodontal membrane is highly cellular, showing many osteoblasts and fibroblasts. New ossification centers are seen lined by osteoid tissue and osteoblasts. In addition there is an attempt for reattachment of the periodontal membrane fibers to bone and cementum.

Dentin • In the control animals the calcified dentin appears as a homogeneous structure and stains evenly with hematoxylin and a mixture of eosin, orange G and erythrosin B. Incremental striations with silver impregnation are also evident. On the other hand, the dentin of the animals on a deficient diet exhibits two definite layers. The pre-experimental dentin is characterized by lighter staining reaction, absence of definite striations, and an increase in interglobular spaces (Fig. 6, #11). The odontoblastic layer remains unaffected.

The dentin from repleted animals show evidence of normal deposition of dentin, as seen in Figure 6, #12. Here three regions are evident: the outer layer appears normal, the intermediate region consists of disturbed dentin and the innermost region represents the dentin deposited during repletion and has the structure of normal dentin.

DISCUSSION

The essentiality of lysine for growth in the young rat has been established for some time, yet there has been a lack of a microscopic study of its effects on the oral

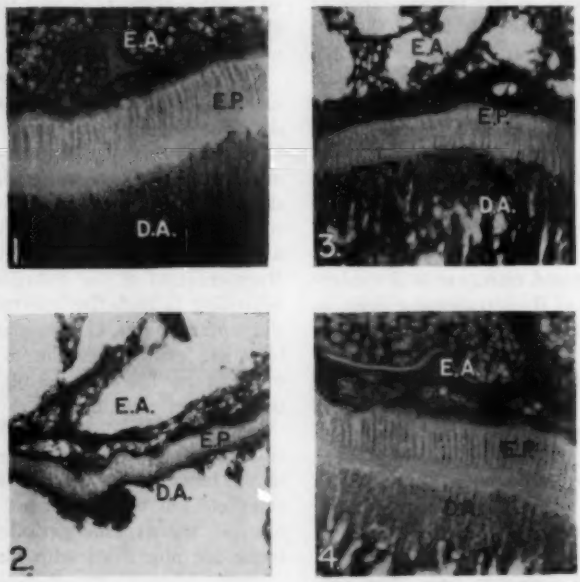
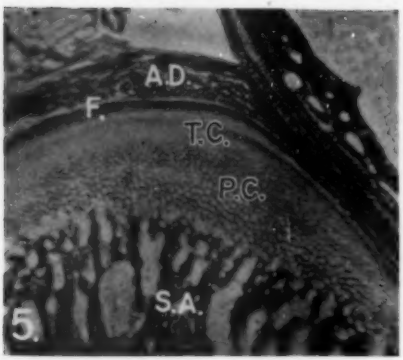


Fig. 2 • Epiphyseal plate area of proximal head of tibia. E.A., epiphyseal area; E.P., epiphyseal plate; D.A., diaphyseal area. #1: Control animal. #2: Animal on diet deficient in lysine seven weeks. #3: Animal on diet deficient in lysine three weeks, then with lysine added four weeks. #4: Animal on deficient diet seven weeks, repleted diet four weeks



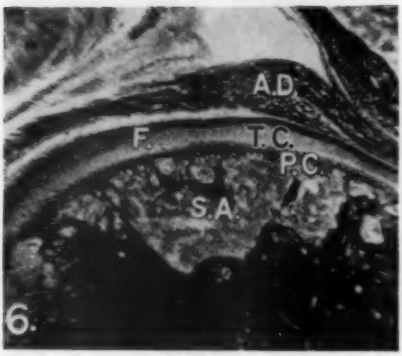
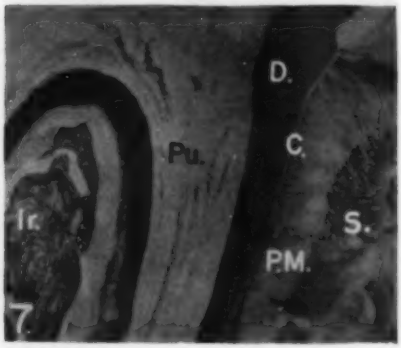


Fig. 3 • Mandibular condyle. A.D., articular disk; F., fibrous layer; T.C., transitional cartilage; P.C., proliferating cartilage; S.A., subchondral area. #5: Control animal. #6: Animal after seven weeks on diet deficient in lysine

structures. The growth of the long bones is dependent on the activity of the epiphyseal plate, and as long as this structure continues to form cartilage as exemplified by the four distinct layers, the bone will increase in length until physiologic closure at the plate takes place. The failure of growth in the experimental animals is reflected in the changes that occur to the epiphyseal plate. There is a progressive narrowing of the plate which is related to the duration of the experiment. This narrowing is due to the inhibition and retardation of chondrogenesis. In this study the proliferating cells apparently failed to mature, to degenerate and finally to calcify. As a result there was no osteogenic replacement. This probably was the result of a failure in protein synthesis.

The condylar cartilage of the mandible is covered by a thick layer of connective tissue which allows appositional and interstitial growth of the condyle. Proliferation of the condylar tissues contributes to the increase of both the over-all length



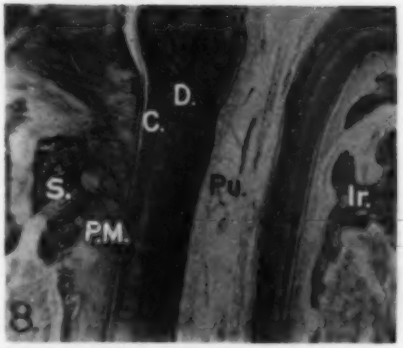
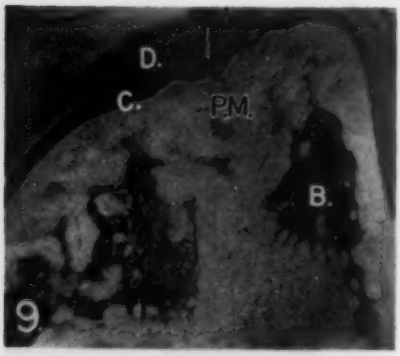


Fig. 4 • Alveolar bone. D., dentin; B., bone; C., cementum; Pu, pulp; Ir, interradicular region; P.M., periodontal membrane; S., septal region. #7: Control animal. #8: Animal on deficient diet seven weeks

and width of the ramus of the mandible. Any change in the condyle would show a decrease in the size of the mandible. It was shown in this study that the growth of the condylar cartilage undergoes retardation and inhibition similar to the epiphyseal plate.

The alveolar bone is known to be sensitive to changes in function and dietary deficiency. In a previous investigation[5] the authors showed that in tryptophan deficiency, osteoporosis of the substantia spongiosa occurs, followed by the destruction of the cribriform plate. As a result of the loss of bone, there is a loss of attachment of the fibers of the periodontal membrane. The animals whose diets are deficient in lysine exhibit these microscopic characteristics. The alveolar bone proper, however, is generally well preserved at first, for it continues to receive some stimuli as a result of the tension exerted by the principal fibers of the periodontal membrane. When these fibers are lost, the alveolar bone degenerates.



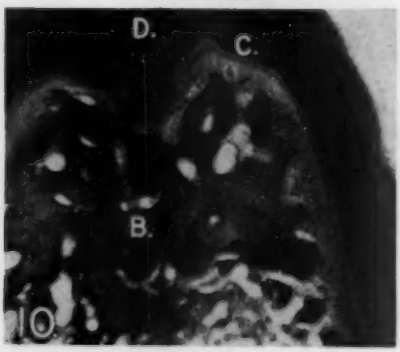


Fig. 5 • Interradicular region. B., bone; C., cementum; D., dentin; P.M., periodontal membrane. #9: Animal on deficient diet seven weeks. #10: Animal on diet supplemented with lysine

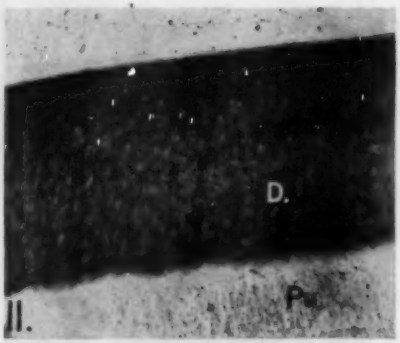


Fig. 6 • Dentin from upper incisor. D., dentin; Pu., pulp. #11: Animal on deficient diet. #12: Animal on diet containing lysine

5. Bavetta, L. A., and others. Effect of tryptophane deficiency on the jaws of rats. J. D. Res. 33:309 June 1954.

The process of calcification is dependent on the formation of a protein matrix. This matrix serves as the ground substance within which the mineral salts are deposited. The failure to calcify in these experiments appears to be largely the result of inadequate matrix synthesis.

Disturbances in deposition of dentin were noted in the experimental animals. The dentin in the incisors which was deposited during the deficiency period appeared to be hypocalcified, as characterized by an increase in the number of calcospherites. With no apparent change in the mineral intake or metabolism, the changes in the dentin must be reflected in the depolymerization of the ground substance and in failure to form a suitable protein matrix.

The degenerative lesions in bone and incisors were found to be reversible when lysine was added to the diet after seven weeks of deficiency. The structures of the long bones resumed their activity as evidenced by the accelerated thickening of the epiphyseal plate and trabeculae. The alveolar bone also reverted to a normal appearing structure.

Physical properties of root canal filling materials

Donald L. McElroy, D.D.S., M.S., Chicago

Numerous materials have been used for the purpose of filling and sealing the root canals of human teeth. Good clinical results with the material employed have been reported. Few men, however, have substantiated their claims with experimental evidence to confirm their clinical findings.

The purpose of a root canal filling is to obliterate and seal permanently the lumen of a root canal from the apical foramen to the crown of the tooth. Such a filling prevents fluid from the periapical tissues and bacteria, whether of hematogenous or lymphogenous origin, from entering the root canal. The tooth thus is prevented from becoming a focus of infection.

An ideal root canal filling material should be as follows:

1. Nonirritating
2. Free from volume change
3. Radiopaque
4. Adaptable to canal walls
5. Sterilizable
6. Insoluble in tissue fluids
7. Nonstaining
8. Easily manipulated
9. Readily removable
10. Nontoxic

REVIEW OF LITERATURE

The modern conception of root canal filling dates to 1840, and since that time many materials have been used for filling

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root canals. A partial list of materials comprises gold foil, gold foil with a shellacked surface, tricalcium phosphate with eugenol, zinc oxide and hydrochloric acid, pulverized animal charcoal with iodoform, orange wood points dipped in Black's 1-2-3, iodoform and phenol paste, oxychloride of zinc and mineral wool, tin foil, lead foil covered with a paste of phenol and iodol, wood points soaked in bichloride or mercury 1:200, red cedar dipped in paraffin, equal parts of zinc oxide and iodoform made into a paste with creosote, cotton points saturated with cinnamon oil or Campho-Phenique, thymol iodide and paraffin mixed with the aid of low heat, phenyl salicylate and balsam in a cone shape, copper amalgam, zinc oxide and eugenol paste, dog dentin, ivory dust and human dentin. The most popular kind of root canal filling material is gutta-percha, either in its solid form or dissolved in a variety of solvents.

Gutta-percha is prepared from the juice of a tree known as the Taban.[1] In 1843 the material was brought to the attention of scientists and manufacturers as an article of utility and value by Sir Jose d'Almedia, a resident of Singapore who had observed natives using it.

In its natural state gutta-percha is nearly white, tough and unyielding. When heated from 50° to 70° C., it becomes plastic. Gutta-percha contains gutta, alban and fluavil in proportions of 78, 16 and 6. It is insoluble in water, saline or alkaline solutions and dilute acids. Concentrated nitric and sulfuric acids attack it. Nitric acid causes the gutta-percha to effervesce and renders it worthless. Gutta-percha slowly absorbs oxygen when exposed to air and light, and in the process it is converted into a brittle resin. Chemically, gutta-percha is a polyterpene[2] and is a polymerized hydrocarbon.

Dental literature records no scientific studies prior to 1918 on the physical properties of gutta-percha in relation to its use in dentistry. In that year W. A. Price,[3] assisted by Dayton C. Miller, published an exhaustive investigation of the physical properties of gutta-percha as a root filling material. Some of their observations follow.

They thought that inasmuch as gutta-percha is a gum, and since gums act similarly to waxes, gutta-percha would be likely to retain locked elasticity. When a thin sheet of gutta-percha was heated to the temperature of boiling water, its length decreased and the breadth and thickness increased. The area of the sheet of gutta-percha contracted, whereas the volume expanded. The linear expansion caused by heating a piece of gutta-percha from which the elasticity had been released by previous heating, however, was slight.

Price and Miller compared the dimensions of the gutta-percha at various temperatures on cooling with the dimension at the same temperatures when rising. There was a lag, which indicated a different dimension for a given temperature in the cooling process. It apparently took considerable time for this lag to disappear completely.

An additional observation made to determine volume change showed that when the temperature was changed from room temperature to that of boiling water, pink gutta-percha increased in volume 2.4 per cent. A piece of uncolored gutta-percha treated the same way increased in volume 2.2 per cent. Every gutta-percha filling is from 1 per cent to 2 per cent smaller after it has cooled to body temperature than it was at the time it was heated and molded into the cavity. Accordingly, if a cavity has a dimension

1. Swain, E. D. Gutta-percha. D. Rev. 4:373 June 15, 1890.

2. Ramsay, Sir William. Experiments on the chemical behavior of gutta-percha. J. Soc. Chem. Industry 21:1367 Nov. 29, 1902.

3. Price, W. A. Report of laboratory investigations on physical properties of root canal filling materials. J. Nat. D. A. 5:1260 Dec. 1918.

of 5 mm., the volume contraction of 1.5 per cent which would occur if the gutta-percha were heated to 75° C. at the time of insertion would open a crevice at the cavity margin sufficient to permit 25 bacteria, each having a diameter of 1 micron, to enter at once.

The heating of gutta-percha to make it plastic is not desirable for molding it to the pulp canal, in Price's opinion; the required plasticity is better secured by means of solvents. The solvents most often used are chloroform, eucalyptol and a chloroform-rosin mixture.

If the pulp canal is filled by a combination of fluid and solid, the change in dimension of both of them must be considered. Gutta-percha dissolved in chloroform to the consistency of a thick paint has a volume 300 per cent greater than in the original material. If the pulp canal is filled with this gutta-percha mixture, the canal is only one-third full when the chloroform evaporates. If sufficient gutta-percha is put into this mixture to occupy 90 per cent of the total volume, the root canal will still lack 6.6 per cent of being filled after the chloroform has disappeared. The greatest error made in connection with a solvent like chloroform or eucalyptol is the presumption that the softening of the surface of the gutta-percha cone by these solvents does not materially change its dimensions. The dimension, according to Price, is changed greatly even by a small amount of chloroform.

Gutta-percha dissolved in chloroform is adhesive when it contains an abundance of chloroform, but loses this quality on losing the chloroform. Root filling materials made with this solvent, consequently, tend to leave the walls and shrink toward a center within the mass, leaving a space at the periphery.

In order to reduce this shrinkage, Callahan[4] developed a rosin-chloroform preparation, and Buckley introduced euca-percha, gutta-percha dissolved in eucalyptol. The ultimate contraction, unfortunately, is similar whether the solvent used is chloroform, eucalyptol or chloroform-rosin.

Euca-percha as supplied on the market has a volume 417 per cent greater than the volume of gutta-percha alone. A pulp canal filled with euca-percha and submitted to a long and complete drying process would have only 24 per cent of the total volume of the pulp canal filled. It solidifies into a lumpy, curdled mass and does not adhere to a smooth surface. The drying process does not finish for a long time. After eight weeks of air-drying at room temperature, euca-percha is reduced to 87 per cent of its original volume. During a similar period, gutta-percha and chloroform were found to have diminished 76 per cent in mass. The addition of artificial heat comparable to body temperature hastened the hardening rate; moisture did not.

Rosin and chloroform mixed to the consistency of sewing machine oil undergo a great reduction in volume during the drying out process, according to the studies of Price and Miller. The mixture has a volume 406 per cent greater than rosin alone. If completely filled, a pulp canal would eventually be only 24.6 per cent occupied by this compound. The addition of gutta-percha cones to supply 90 per cent of the total volume would still leave approximately 7.5 per cent of the pulp canal unfilled when the complete drying out process had occurred. When a gutta-percha cone is placed in this liquid it rapidly swells, expanding from one-fourth to one-half its normal volume during the softening process. When a pulp canal is filled with a fluid or semifluid material, it is a physical impossibility while the solvent is present to add sufficient material to compensate for the reduction in volume produced by the evaporation of the solvent.

4. Callahan, J. R. Rosin solution for sealing of dentinal tubuli and as an adjuvant in filling root canals. J. Allied D. Soc. New York 9:53, disc., 110 March 1914.

The rosin and chloroform mixture is adherent to smooth and rough surfaces in all stages of setting. When a root filling is made of this material and gutta-percha cones, therefore, the contraction tends to pull the material toward the periphery, if the canal walls are dry, rather than away.

A "skin" is formed on the surface of chloro-percha and, especially, chloroform-rosin. The formation of this skin delays the drying process. When chloro-percha is used in a pulp canal, the skin or film separates from the canal, leaving a fault. A series of caverns ultimately is formed, each cavern projecting from the last until the entire mass is honeycombed. A chloroform-rosin mixture in a pulp canal retains the continuity of the protecting surface skin by its adherence to the wall. Underneath this film, the liquid retains nearly all of its original fluidity because of the control of the vapor tension by this membrane. It is many months, therefore, before root canal fillings composed of these mixtures attain their maximum contraction and solidification.

After air-drying in an open vessel for two weeks, chloroform-rosin is reduced to 65 per cent of its original volume, in five weeks to 59 per cent, and in eight weeks to 36.4 per cent. The last 12 per cent of the total shrinkage requires a long time or the addition of artificial heat.

In 1931 Buchbinder[5] reported experiments with the packing of various root filling materials into glass tubes. He found that chloro-percha, chloroform-rosin and euca-percha pulled away from the walls of the tube, leaving visible air holes. In each instance the shrunken mass readily absorbed a stain into which it was immersed. His experiments further proved that shrinkage inevitably resulted when these materials were used.

It has been stated that when chloroform-rosin is placed in a root canal the adhesion to the dentinal wall will not be broken, but as a result the material is eventually honeycombed. Whether this is true with a thoroughly desiccated dentinal wall has not been proved. It would not be true if there were an appreciable amount of moisture in the tubules at the apical one third of the root canal, because the moisture would prevent the adherence of the filling material to the dentin wall.

In the quest for a material that would seal permanently the apical one third of the root canal and at the same time be well tolerated so as not to cause inflammation of the periodontal tissues, Rickert[6] developed his "root sealer." The composition of the material is as follows:

Powder

Precipitated silver 30 Gm.
Zinc oxide 41.21 Gm.
Thymol iodide 12.79 Gm.
White rosin 16 Gm.

Liquid

Clove oil 78 cc.
Canada balsam 22 cc.

MATERIALS

In the study hereinafter described, the following materials were examined:

1. Gutta-percha.

2. Wach's root canal filling compound. The formula for this material follows:

Powder

Zinc oxide 10 Gm.
Calcium phosphate 2 Gm.
Bismuth subnitrate 3.5 Gm.
Bismuth subiodide 0.3 Gm.
Heavy magnesium oxide 0.5 Gm.

Liquid

Canada balsam 20 cc.
Clove oil 6 cc.

5. Buchbinder, Maurice. Non-shrinking root canal material. D. Cosmos 73:14 Jan. 1931.

6. Rickert, U. G., and Dixon, C. M., Jr. Tissue tolerance to foreign materials. J.A.D.A. 20:1458 Aug. 1933.

Eucalyptol 0.5 cc.
Beechwood creosote 0.5 cc.

3. Kerr's (Rickert's) sealer
4. Chloro-percha (thick and thin mixes)
5. Callahan's chloroform-rosin
6. Silv-o-dent
7. Neo-Balsam
8. Perma-fix
9. Sterident
10. Cargenol

VOLUME STUDY

Method • There is a slight elasticity in teeth which is not present in a metal container. It was demonstrated[7] that silver amalgam packed into a small, smooth glass tube reacted differently from that packed into an etched glass tube. A similar result might occur when root filling materials are used in smooth, hard containers. It was decided, therefore, that extracted teeth should be used in the experiment.

Single-rooted teeth were selected, and their root canals were enlarged to a uniform size so that the different filling materials tested would occupy the same volume. The enlargement was made by running a No. 560 cross-cut fissure bur through the root canal to the apex. The teeth were then grooved on their external surfaces by means of a knife-edge stone. The grooves were cut longitudinally on the labial, lingual, mesial and distal surfaces. A cut was made around the circumference of the mid-root (Fig. 1, above), in order that the tooth might be split along clean fracture lines, making it possible to observe any gross changes in the volume of the root canal fillings inside the teeth.

After the grooves were made, the teeth were embedded in copper rings containing softened modeling compound (Fig. 1, below), leaving one end exposed. The opposite end was embedded in the compound so that a hard surface was provided against which to pack the root filling material. Condensation is important in placing a root canal filling. The material must be placed to the apex under pressure if it is to seal completely the canal. Price and Miller failed to mention this consideration.

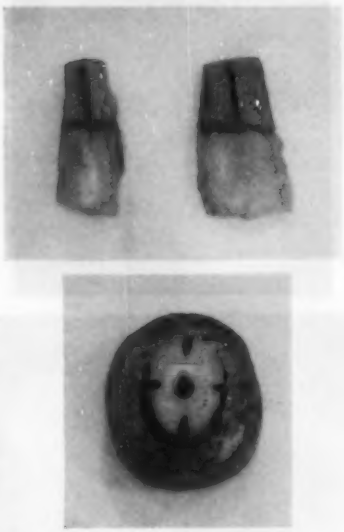


Fig. 1 • Above: Side view showing grooves to enable splitting of tooth. Below: Tooth embedded in modeling compound ready to be packed with root canal filling material

The materials were employed in the following manner: Gutta-percha cones were softened by heating to make them adaptable to the root canal surface. The gutta-percha was introduced and packed into the enlarged canal by means of root canal pluggers. All the other materials combine when mixed to make a plastic mass. They were mixed according to the manufacturer's directions and were introduced into the enlarged canals by means of an absorbent paper point, coat-

7. Souder, Wilmer. Measurement and application of certain physical properties of dental amalgam. J. D. Res. 7:173 June 1927.

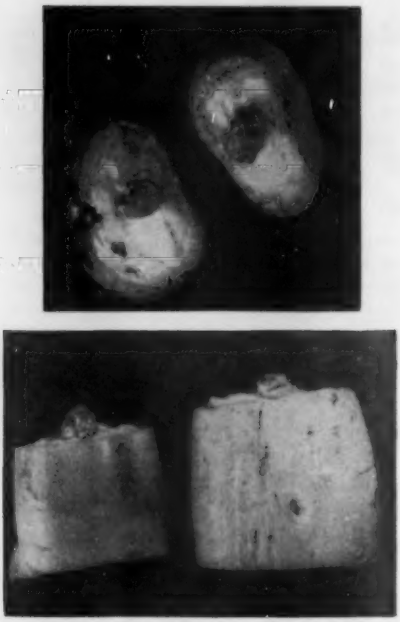


Fig. 2 • Above: Top view of teeth after being split open to examine crevice between root filling material and dentinal wall. Below: Side view of tooth after splitting

ing the lumen of the roots. After this procedure, a gutta-percha cone of the approximate diameter of the root canal was introduced into the plastic mass and compressed against the walls of the root canal with spreaders.

After a number of these roots were filled, it was determined that it was not possible to split the tooth without interfering with the root filling material (Fig. 2, above and below). Because of the failure to get a smooth fracture, it was difficult to examine for a crevice between the filling material and the dentinal wall.

After many kinds of containers for testing root filling materials were examined, a brass tube which screwed into a solid base with a friction fit where base and tube met was designed (Fig. 3). The lumen of the tube had a surface which was not polished; the roughened finish somewhat resembled a prepared root canal. Thus, if a mechanical grip between the root filling material and the wall of a tooth were possible, this property would be simulated.

The root canal filling materials listed previously were packed into the rings, which were then separated from their bases and immediately placed in a moist chamber and kept in an incubator at a temperature of 37° C. The purpose of the moist chamber was to simulate the condition existing at the apex of a tooth where a root canal filling material would be exposed to the body fluids at 37° C. The separation was not effected until the material had set sufficiently to remain undisturbed by the separation. After testing the various materials by trial and error, it was found that a minimum of 30 minutes was necessary before separating the rings from the bases. The rings were placed on a platform in a sealed glass jar. Under the platform was a dampened piece of cotton to supply moisture.

At the end of one week the rings were removed from the incubator and examined under a dissecting microscope to determine whether or not a crevice existed between the ring and the material.

Results • The thick and thin mixes of chloro-percha combined with gutta-percha and Callahan's chloroform-rosin

Fig. 3 • Brass tube for testing root canal filling materials

combined with gutta-percha indicated the greatest volume change. Wach's filling compound, Neo-balsam and Rickert's sealer, each in combination with gutta-percha, showed the least volume change.

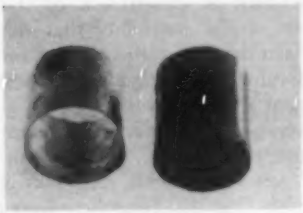


Fig. 4 • Copper band and root canal filling material separated from band

POROSITY STUDY

If a root filling material is porous, it cannot be considered safe for use in a root canal, because tissue fluid and bacteria may enter into the permeable filling material and create a focus of infection at the apical end of the tooth.

Method • Samples of the various root filling materials of uniform size and surface area were placed in methylene blue dye for one week. The samples were then removed and split with a sharp razor, but it was difficult to determine

Table • Weight change in mg. of root filling materials

Sample		Average weight	Weight after immersion	Net gain	Average gain
Gutta-percha	1	315.73	317.8	2.07	
	2	333.1	335.1	2.00	
	3	288.2	290.6	2.40	2.15
Rickert's sealer	1	353.4	356.1	2.70	
	2	333.15	334.8	1.65	
	3	323.4	325.5	2.10	2.15
Chloro-percha	1	285.5	294.9	9.40	
	2	394.96	401.7	6.74	
	3	257.6	265.0	7.40	7.84
Neo-balsam	1	389.9	390.5	0.60	
	2	290.36	291.6	1.24	
	3	337.96	338.6	0.64	0.82
Callahan's Chloro-form rosin	1	370.86	379.7	8.84	
	2	374.03	378.3	4.27	
	3	341.0	346.2	5.20	6.10
Steri-dent	1	270.0	273.9	3.90	
	2	281.5	284.1	2.60	
	3	286.85	290.3	3.45	3.31
Cargenol	1	389.66	395.70	6.11	
	2	246.20	249.4	3.20	
	3	345.80	350.4	4.60	4.63
Silv-o-dent	1	292.06	298.0	5.94	
	2	289.80	296.3	6.50	
	3	327.06	333.4	6.34	6.26
Wach's filling material	1	375.53	376.1	0.57	
	2	430.0	430.8	0.80	
	3	390.96	391.6	0.64	0.67

the amount of penetration of the dye because of the possibility that the dye had been dragged across the cut surface. To eliminate this difficulty, the next experiment was designed.

Twenty-seven copper bands, each with a diameter of 4 mm. and a length of 3 mm., were filled with nine root filling materials (Fig. 4). Thus there were three samples of each material, and all samples had approximately the same surface area. After solidification the bands were split and peeled away from the root filling material, so that all surfaces of the sample were exposed. Each specimen was placed in a separate glass container and then placed in a covered jar above a base containing moist cotton. This procedure was followed to provide an environment similar to that found in the oral cavity. At no time were the samples in actual contact with the wet cotton.

The jar containing the samples then was placed in an incubator at 37° C. The samples were removed at the end of one week. They were weighed on a gravimetric balance, the weights were recorded and the samples were returned to the incubator. This process was repeated for two successive weeks, until a relatively constant weight for each sample was reached.

The samples were immersed in human blood serum in their own glass containers, and all 27 then were set in the moist covered jar and placed in the incubator at 37° C. After one week the samples were taken from the serum and the excess fluid was removed with a gentle blast of compressed air for one minute. After the removal of the fluid, the sample was weighed on the gravimetric balance.

Results • The amount of tissue fluid taken up by the root canal filling material can be noted in the table. Wach's compound made the least increase in weight, and Neo-balsam gained little more. The weight gain of gutta-percha was over 3 times and chloro-percha almost 12 times that of Wach's compound. The increase in weight seemed to be caused mainly by the absorption of serum by the material. Wach's compound was the least porous and chloro-percha the most porous and, therefore, the poorest of the materials tested.

SUMMARY AND CONCLUSIONS

The physical properties of root canal filling materials have been studied, and the following conclusions have been drawn:

1. Well condensed gutta-percha and gutta-percha in combination with a root sealer in the form of Wach's filling material, Neo-balsam and Rickert's sealer exhibited a minimum volume change.
2. Materials which employed gutta-percha modified by chloroform, namely chloro-percha and chloroform-rosin, showed the greatest change in volume.
3. Wach's compound was the least porous and chloro-percha the most porous of the materials tested.
4. Further investigation is necessary to produce the ideal root canal filling material.

Capital • Books constitute capital; a library book lasts longer than a house; it is not, then, an article of mere consumption but it is capital. *Thomas Jefferson.*

The craniophorometer

George T. Perkins, D.D.S., Aurora, Ill.

A new head device, the craniophorometer, has been developed in the hope that, through its use, knowledge regarding the temporomandibular joint will be increased. The great need for a tangible means of studying normal mandibular position as well as the relation of the condyle to the fossa while in centric and eccentric relationship has been recognized. It is true that the dentist has at his disposal mechanical means such as the Gothic arch tracing for determining centric relation. Roentgenograms, however, provide the best means for studying relationships. To provide this graphic or visual means requires the accurate duplication of roentgenograms. Such duplication is difficult to achieve with the accepted technics. The work of such early investigators as Broadbent,[1] Riesner,[2,3] Ennis,[4] Goodfriend,[5] and more recently Boos,[6] were studied and plans formulated for a three-dimensional head-holding device.

Initially the requirements were to design and construct an apparatus for the accurate duplication of lateral views of the temporomandibular joint. As work progressed, however, it was decided to make the instrument more versatile. After four years and six modifications, the desired results were obtained. The device will now duplicate roentgenograms of the temporomandibular joint as well as facilitate the taking of anteroposterior and lateral cranial views.

APPARATUS

The device is made of light weight aluminum, is calibrated in the metric system and is easily adapted to the headrest of any dental chair. The accessories required consist of a central ray locator, bizygomatic ruler and a filter attachment for the x-ray head.

Figure 1 shows the device mounted on the headrest of the dental chair. The principal parts are as follows:

1. A 360-degree revolving disk with stops located both right and left at 45 degrees.
2. The head top.
3. Zygomatic suture locators.
4. Chin arm.
5. Vertical chin adjustment.
6, 7. Cassette holders.
8. Cassette crank.
9. Plexiglas grid.

Presented before the twenty-second annual postgraduate clinic of the District of Columbia Dental Society, Washington, D. C., March 1954.

Formerly, dental division, Army Medical Service Graduate School, Walter Reed Army Medical Center, Washington, D. C.

1. Broadbent, B. H. A new x-ray technique and its application to orthodontia. Angle Orthodont. 1:45 April 1931.

2. Riesner, S. E. Extraoral radiodontic technic. Int. J. Orthodont. (Oral Surg. Sect.) 23:409 April 1937

3. Riesner, S. E. Roentgen technique for the mandibular joint. Int. J. Orthodont. (Oral Surg. Sect.) 23: 740 July 1937.

4. Ennis, L. M. Dental roentgenology, ed. 4. Philadelphia, Lea & Febiger, 1949.

5. Goodfriend, David. Personal communication.

6. Boos, R. H. Condylar path by roentgenograph. J. Pros. Den. 1:387 July 1951.

10. X-ray head filter and pointer attachment for the central ray.

11. Central ray locator (not shown).

12. Leveling bar with vernier adjustment (see Fig. 2).

The 360-degree disk (1) allows the instrument to be rotated and is secured to the headrest of the dental chair by means of an attachment having a vernier adjustment (12) for leveling the device to the vertical plane (Fig. 2). The head top (2) is calibrated in a vertical plane and supports the zygomatic suture locators (3). These locators may be removed from the head top and are adjustable in the sagittal, vertical and horizontal planes to predetermined anatomic landmarks. The chin arm (4) may be moved horizontally and adjusted vertically at (5). The freely movable cassette holders (6,7) are loaded from the top and may be adjusted to the head by the use of the hand crank (8). A clear Plexiglas grid (9) is depicted in the left cassette holder; it can be used on the right side as well and contains 12 etched, 1 cm. grids in both the horizontal and vertical planes. The filter modification (10) for the x-ray head consists of a circular lead disk with a centered 1 inch aperture and an aluminum filter 1 mm. thick. The 1 inch aperture allows the field to be pinpointed by the central rays and reduces secondary radiation.

TECHNIC

To duplicate roentgenograms of the temporomandibular joint, the operator must adhere carefully to the following technic

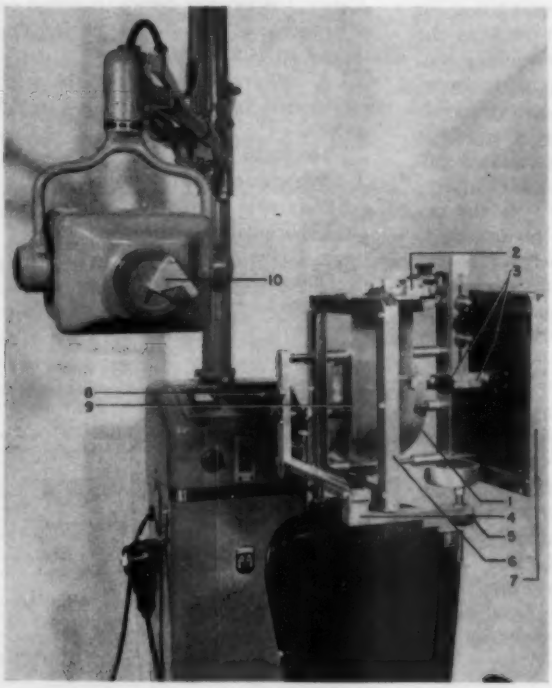


Fig. 1 • (1) 360-degree revolving disk adjustable to 45 degrees both right and left; (2) head top; (3) zygomatic suture locators; (4) chin arm; (5) vertical chin adjustment; (6 and 7) cassette holders; (8) cassette crank; (9) Plexiglas grid which is divided into 12 horizontal and vertical grids; (10) x-ray head filter and pointer attachment

which is precise and utilizes a precision-built instrument; therefore, accuracy in the keeping of records is of paramount importance. Figure 3 shows a sample of the blank on which data were recorded concerning the original roentgenogram. From these data, a duplicate capable of being superposed may be obtained if careful attention is paid to the procedures. First, four points are tattooed on the individual's head. The first two are made with the aid of the central ray locator on either side of the subject's head. This locator fits easily into either the right or left external auditory meatus and extends forward 2 cm. and is 2.5 cm. above the tragus. Here there is a convenient hole for the indelible tattoo which is placed in an area just above the glenoid fossa. This tattoo becomes the focal point of the central rays and was arrived at by a trial-and-error method after many attempts to eliminate superimposition of bony structures. Its significance and application will be discussed later.

The final tattoo points are located and placed by palpating for the temporal canthus of each eye at the zygomatic sutures. These landmarks were selected because of the ease with which they can be located and because they will not change with gain or loss of weight.

Next the bizygomatic distance between condyles is measured by means of a metric ruler, and the measurement is recorded. It is this finding which determines the exposure time. A chart then may be referred to which gives all the information relative to time, kilovolts, milliamperes and the roentgen dose. Af-

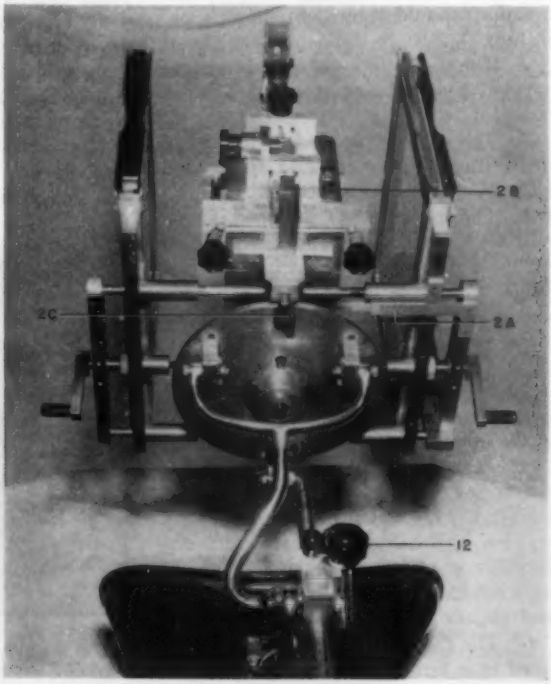
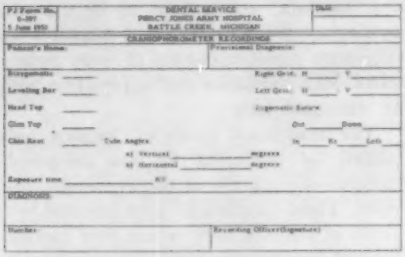


Fig. 2 • Top and rear view of device illustrating attachment to headrest, vernier adjustment (12), cassette calibration shown at 2A, spirit level at 2B and the head top adjustment wing nut at 2C


DENTAL SERVICE
PERCY JONES ARMY HOSPITAL
BATTLE CREEK, MICHIGAN

CRANIOPHOROMETER RECORDINGS

Patient's Name | Provisional Diagnosis

Zygomatic | Right Grid: H V
Leveling Bar | Left Grid: H V
Head Top | Zygomatic Suture
Chin Top | Ant Post
Chin Rest | Tube Angles: In Rt Left
a) Vertical degrees
b) Horizontal degrees
Exposure time KV

DIAGNOSIS

Number | Recording Officer (Signature)

Fig. 3 • Record card kept on all patients

ter the preliminary work is completed, the subject is seated in the chair, placed in the device and the following procedures are carried out as outlined:

1. The headrest (2) is raised (Fig. 1) to its upper limit, and then the whole device is lowered by disengaging the clutch found on the headrest arm until the cassette holders (6,7) clear the individual's shoulders by approximately two inches.

2. The head top (2) is lowered to engage the head and secured. (This is recorded.)

3. The device is leveled by the use of the vernier adjustment and spirit level (Fig. 2). (This also is recorded.)

4. The chin arm (4) is slipped into its proper channel and secured firmly underneath the individual's chin; the final adjustment as to the desired opening is left to the micrometer (5). (These data are recorded.)

5. The Lysholm grid cassette is placed in the holder (6,7) on the side to be filmed and the Plexiglas grid (9) is placed in the opposite holder. This type of cassette was selected in preference to the conventional cassette because it has built-in metal grids which control the divergent rays and reduce secondary radiation. In other words, by preventing or reducing secondary scatter, better definition and clearer pictures are obtained.

6. The cassette holders are moved inward to a firm position on each side of the patient's head by means of the hand crank (8). (Record is made of the position.)

7. The zygomatic suture locators (3) are attached to the channel provided on the head top (2) and each locator is adjusted vertically and sagittally to the predetermined tattoo points. (These data are recorded.)

8. The previously tattooed central ray focal point may be seen through the Plexiglas grid. A red wax pencil is used to indicate its exact location within the gridded area, and this is recorded. This red dot will now assist the operator in adjusting the tube locating pointer in contact with the Plexiglas grid. The x-ray tube is set at a vertical angle of 20 degrees and a horizontal angle of 105 degrees and the pointer is on the red dot.

9. The tube locating pointer is swung out of the roentgen ray field and is exposed (Fig. 4).

To take roentgenograms of the opposite condyle, the tube is swung to the other side of the patient's head and the same procedure is repeated as outlined in no. 8.

The operation and exposure chart (Fig. 3) was formulated for use with a well known dental x-ray unit. This unit

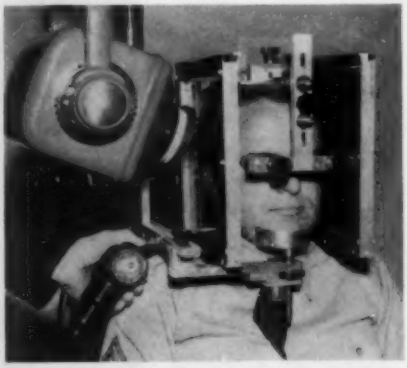


Fig. 4 • Exposing left temporomandibular joint

was instrument-checked for accuracy as to its power output, and for the purpose of this study it was decided to use 60 kilovolts at 10 milliamperes and a focal-film distance of 22 cm. Again, by the trial-and-error method, the base line from which the exposure time may be calculated easily was determined. This was found to be nine seconds with a bizygomatic measurement of 15.5 cm. Thus, by adding or subtracting one second per 0.5 cm. either way from the base line, the correct exposure time can be calculated. In addition, the roentgen dose for each patient at this base line is 6.3 r and should not exceed 75 r per week. Furthermore, individuals should not be subjected to exposure for more than three succeeding weeks, and at least three should intervene before re-exposure.

To insure accuracy of reproductions or duplications, two factors are most important: the power output of the x-ray unit must remain constant throughout the timing cycle and the developing technic must be controlled closely. The constancy of the timing cycle is mentioned because it was found that, as a result of the wear and tear on the hand switch, there was often a one-second lag which seriously affected definition and the desired contrast. The developing baths were thermostatically controlled, and frequent exhaustion point checks were made of the developing solution to further assist in attaining perfection.

COMMENT

A question most frequently asked is, "How do you eliminate superimposition of bony structures?" Since the skeletal anatomy of individuals varies, it may be necessary to make three exposures in order to eliminate superimposition of these structures. A vertical angle of 20 degrees was found to be the best for most individuals; however, this may be raised or lowered 5 degrees for better definition. After the proper vertical angle has been selected, all measurements taken may be repeated with accuracy and duplicate roentgenograms made.

Figure 5 illustrates the versatility of the device and Figure 6 shows a typical view of the temporomandibular joint. For the lateral view shown in Figure 5, the instrument is rotated to exactly 45

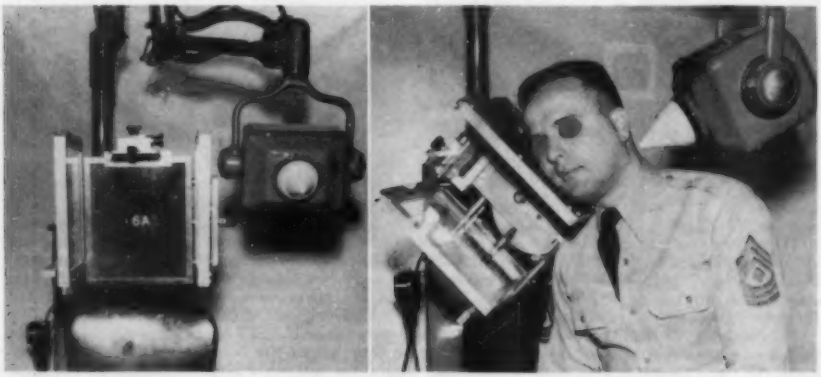


Fig. 5 • Left: Instrument rotated to 45 degrees and locked into position for lateral view. Patient sits on lowered arm of chair. Right: Standard 8 x 10 cassette (6A) is being held in rear channel for anteroposterior views

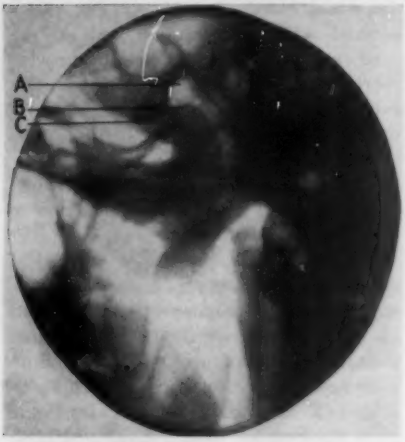


Fig. 6 • A typical view of temporomandibular joint. A, glenoid fossa; B, condylar head; C, articularis eminentia

degrees and is locked into position. Figure 5, right (6A) shows a cassette being held in the channel provided for the taking of anteroposterior roentgenograms. For this exposure, the device may be tilted to any position desired by means of the vernier leveling arm. Figure 6 shows the clarity of a roentgenogram taken by this method. What is more important is the fact that this result can be duplicated at any subsequent time, if the technic is followed carefully.

The craniophorometer has been in use for several years. During this time it has proved invaluable not only in the field of prosthodontics but also in oral surgery: for example, in studying the position of the condyle in centric occlusion, physiologic rest, and while exerting maximum masticatory pressure. In oral surgery it has also been used to determine the location of fractures, foreign bodies, and the position and extent of condylar fractures. Recently roentgenograms have been made in 25 cases, and the condyle has been shown under maximum masticatory pressure. In addition, it is believed it will be of help in the field of orthodontics; through its use it will be possible to study the temporomandibular joint in relation to the growth pattern in persons wearing appliances for the correction of underdeveloped mandibles. Since only a few anteroposterior views have been taken, further exploration will be required before a more realistic evaluation can be made; however, when close attention is paid to detail, roentgenograms of the temporomandibular joint can be superposed.

820 Hardin Avenue

Submerged Third • The hazards of illness and accident seem to fall disproportionately on a small minority of the population. A recent study of the health records of telephone company employees showed that a third of the individuals accounted for about 75 per cent of the total illnesses and 80 per cent of the days missed from work. The study was reported at a Buffalo meeting of the American Public Health Association by Lawrence E. Hinkle, Jr., and Norman Plummer, assistant professors of medicine at Cornell University Medical College.

They had traced the records of 1,297 telephone operators and 1,527 repairmen. All the workers had been screened for physical defects at the time they joined the company; all apparently enjoyed the same adequate standards of nutrition, sanitation and other physical comforts. Yet some suffered a succession of major and minor illnesses, while others remained almost untouched. Those who got sick showed a general susceptibility rather than specific weaknesses. The sickly workers also had more accidents than the others. *"Science and the Citizen," Scientific American 192:46 January 1955.*

BUREAU OF LIBRARY AND INDEXING SERVICE

"Troublesome terms"
The nomenclature conference, 1954

Reviewing some of the old terms in the dental vocabulary which have been troublesome, the nomenclature conference held last September under the sponsorship of the Bureau made a number of interesting suggestions. Some of the terms studied had been patently troublesome for many years. Some seem never to have been noticed by the profession as anything peculiar. In the latter group is the term *case* as used in a material sense for decades by prosthodontists. Perhaps the only instance of its being recognized in the literature as an oddity is the mention, in quotation marks, by M. D. K. Bremner in the latest edition of his *Story of Dentistry* (1954) in the following sentence:

> The laboratory technician not only suggests, but will quite frequently exercise his own judgment in the construction of a "case" or an appliance.

As nearly as the term "case" can be defined in the jargon of the laboratory, it is the prosthesis at any stage of construction before completion. The committee felt that the term could and should be avoided by indicating the specific stage of the work accomplished. However, even though "case" is an unfortunate choice, there still may be a need, as yet unsupplied, for a general term to designate the prosthesis in the making at all or any of the stages of its progress. Perhaps, *the work* is such a term.

PRINCIPLES OF SELECTION

In order to avoid being influenced by whim and prejudice in the judgment of words, the conference adopted some guiding principles. It was recognized that, as words at best are but imperfect symbols, it is often necessary to choose, not the ideal term, but a compromise term, the properties of which are at odds with each other. The extent to which a usage exists, is a powerful consideration in determining the most useful term, and therefore coinage of new words should be a last resort. The more extended usage in several sciences often gives preference of one term over another employed in only one department of knowledge. Much of the work of one committee, of which Harry Sicher was chairman, was based on this principle as applied to usage restricted to dentistry and usage in comparative anatomy and other sciences. The committee recommended *canine* in place of *cuspid* and *premolar* in place of *bicuspid* largely on the grounds that the terms of science were more generally understood and employed than those used in American dentistry alone.

In some measure, too, what is true of

words is also true of concepts for which words stand. Concepts of frequent use need economical symbols (that is, specific terms) to represent them, whereas concepts of only infrequent or occasional employment may be represented by descriptive phrases.

Although terms cannot be completely descriptive of the concepts for which they stand, it is desirable in the coinage and selection of compound terms to build them in such a way that the important relations of the concepts will be paralleled by the word form. Related diseases should be represented by roots and endings expressing the relationships as with *-itis* and *-osis*. Species and genus names, that is classes and subclasses, should, if possible, be similarly designated. Eponymic terms are objectionable since they are undescriptive and are incapable of any inflectional modification to express relation.

Scientific terms should possess a certain reticence; that is, a term should generally suggest no more than is necessary to identify the concept for which it stands, thus allowing for change and development of the concept with growth of knowledge. Certainly, the term should suggest nothing foreign to the concept and nothing which is not definitely known. Symptomatic terms are superseded by pathological and etiological terms when conditions and causes have been established beyond doubt.

Although it is sometimes advantageous for literary purposes to have several terms for the same concept, it is usually confusing and unsatisfactory to have a single term represent several concepts.

Paralleling purposive and functional terms, it is usually desirable to have objective and structural terms. In biology, this principle implies that physiological terms should be paralleled by anatomical terms, as *circulating system* is paralleled by *cardiovascular system*.

With these principles in mind, the various committees of the conference reviewed a number of old terms about which question had been raised.

NAMES OF SPECIALTIES

One workshop committee, of which Kenneth Easlick was chairman, considered the names by which the various departments of dental practice were designated.

It was pointed out that the term *operative dentistry* long ago had ceased to be descriptive of the branch of practice to which it is applied. At the beginning of the nineteenth century, dental practice was regarded as consisting of *mechanical dentistry* (work done in the laboratory apart from the patient) and *operative dentistry* (work done at the chair in the presence of the patient). *Operative dentistry* at that time was an amply descriptive term, and indicated everything from removal of teeth to restoring them. Since then, the content of operative dentistry, especially in school curriculums, has varied considerably at different times and in different schools. In recent years, the concept of restoration of the individual tooth has become largely identified with the term. For this reason, the terms *restorative dentistry* and *conservational dentistry* have been suggested, and to a limited extent employed, as substitutes for *operative dentistry*.

The committee did not feel justified in recommending a radical change, but suggested in view of the restriction that had taken place in the content of the operative department, that the definition and name could well be reviewed by interested groups, especially by the American Association of Dental Schools. Out of such a consideration, some positive solution of the problem might come forth.

In connection with the discussion of operative dentistry, the term *restoration*, preferred by many dentists as a substitute for *filling* or *inlay*, came up for consideration. The prosthodontists present felt that the term should carry a wider sig-

nificance since in a liberal sense, all prosthesis is *restoration*. This is a problem that should be adjusted between prosthetists and operative dentists.

In harmony with the general trend in biology and medicine to reserve the *-ia* ending for physical and mental conditions and in accord with the general tendency in dentistry today, it was felt that the *-ics* ending to indicate practices of dentistry was preferable. Thus, the names of the specialties would be *periodontics, pedodontics, endodontics, prosthodontics, orthodontics.*

ORTHODONTIC NOMENCLATURE

The terms *initial contact* and *premature contact* (or *prematurity*) are among the newer expressions that came up for consideration. Since occluding contacts of the teeth cannot be *mature* or *premature* in any real sense, a change in terminology seemed called for. The committee dealing with orthodontic concepts, of which T. D. Speidel was chairman, suggested that *initial contact*, sometimes defined as a normal contact and sometimes as an abnormal contact, should be regarded as a generic term representing the first contact of teeth on closing the jaws, to be used with a modifying word when its specific character was in view, as *normal initial contact*. Initial contact, when unsatisfactory, might be of two kinds, *interceptive*, when the closing action was prevented from completion, and *deflective* when the action of the jaw was diverted from its normal path in order that closure should be completed. These terms would then supersede *premature contact* and *prematurity*.

PERIODONTAL TERMS

The committee which reviewed periodontal terminology, under the chairmanship of F. J. Orland, considered the term *periodontal membrane* earlier referred to as the *peridental membrane*. In view of the chief function of the structure—suspending the tooth in its socket—the committee suggested modifying its designation to *periodontal ligament*, or better *periodontal ligaments*, consisting of the substructures, *alveolodental ligament, gingivodental ligament*, and *interdental ligament*.

PROSTHODONTIC TERMS

Several terms in prosthodontics were discussed. One committee, under the chairmanship of S. D. Tylman, favored the use of the term *partial denture* for all prosthesis replacing less than all the teeth. This recommendation was in harmony with the report of the Curriculum Survey Committee[1] in 1935, and was based on the idea that *denture* is a term more in keeping with the biological function of a partial prosthesis than is the mechanical term *bridge*. The conference committee also suggested that the term *saddle* should be superseded by the term *partial denture base*. The committee on complete denture terminology, under C. O. Boucher, reinterpreted the term *articulation*, as employed in prosthodontics, restoring it to its original meaning as a means of joining the oral models similarly to the articulation of the jaws by the temporomandibular joint. This suggestion has been amply discussed in an editorial[2] in THE JOURNAL. For such expressions as *closing the bite* and *opening the bite*, the phrases *decreasing the vertical dimension* and *increasing the vertical dimension* were proposed for precision.

CARIES NOMENCLATURE

Some of the terminology of caries research occupied the committee of which G. J. Cox was chairman. In keeping with the style adopted by THE JOURNAL in

1. A course of study in dentistry. Report of the curriculum survey committee, American Association of Dental Schools. Chicago, American Association of Dental Schools. 1935, p. 271-272.
2. Editorial. J.A.D.A. 49:[illegible] Nov. 1954.

1950, the use of *fluoridation* to indicate the addition of fluoride to public water supplies and the use of *fluoridization* to designate topical application of fluoride solution to the teeth were recommended. The term *caries,* contrary to all good usage, has in recent times come to be used by many researchers as a plural noun indicating, for statistical purposes, instances of caries. It was pointed out that the term *carious lesions* was for this purpose at once correct and precise.

NOMENCLATURE PROJECT FOR 1955

The work carried on by the nomenclature conferences of 1952, 1953, and 1954 will be continued by George B. Denton under the sponsorship of the Bureau of Library and Indexing Service. It is proposed during the year 1955 to engage the interest of educators, editors, dental examiners, librarians, and authors, in specific nomenclature problems as they arise, by means of circulars and correspondence.

Copies of the reports of the three conferences under the titles "Concepts of Occlusion," "Supplementing the Dental Dictionary," and "Troublesome Terms," respectively, are available on request to Director, Bureau of Library and Indexing Service, American Dental Association, 222 E. Superior St., Chicago.

Additions to the Library

The books listed here have been added recently to the Library collection. Requests for this material, available on loan to all members of the Association, should be addressed to the Bureau of Library and Indexing Service. There is no charge for borrowing books. Most of the books may be purchased also through the Library.

BOOKS

AMERICAN DENTAL ASSOCIATION. American dental directory, 1955. Chicago, The Association, 1954. 1,077 p. $7.50.

AMERICAN DENTAL ASSOCIATION. COUNCIL ON DENTAL HEALTH. Fluoridation in the prevention of dental caries. 4th ed. Chicago, The Association, 1954. 31 p.

AMERICAN DENTAL ASSOCIATION. COUNCIL ON DENTAL THERAPEUTICS. Accepted dental remedies. 20th ed. Chicago, The Association, 1955. 207 p. $2.

ARSTAD, THOR. The capsular ligaments of the temporomandibular joint and retrusion facets of the dentition in relationship to mandibular movements. Oslo, Akademisk, 1954. 95 p. $2.85.

BEECHER, H. K. & TODD, D. P. A study of deaths associated with anesthesia and surgery. Based on a study of 599,548 anesthesias in 10 institutions, 1948-1952, inclusive. Springfield, Thomas, 1954. 66 p. $2.75.

BOND, F. A. Our needy aged; a California study of a national problem. New York, Holt, 1954. 401 p. $4.50.

BREMNER, M. D. K. The story of dentistry from the dawn of civilization to the present. 3d ed. Brooklyn, Dental Items of Interest, 1954. 462 p. $7.

BRETZ, RUDOLPH. Techniques of television production. 1st ed. New York, McGraw-Hill, 1953. 474 p. $10.

DEWHURST, HUBERT. Introduction to 3-D. New York, Macmillan, 1954. 152 p. $4.50.

EWING, J. E. Fixed partial prosthesis. Philadelphia, Lea & Febiger, 1954. 208 p. $6.

FASTLICHT, SAMUEL. Bibliographia odontologica Mexicana. Mexico, La Prensa Odontologica Mexicana, 1954. 220 p. $4.

GRAY, HENRY. Anatomy of the human body, edited by Charles Mayo Goss. 26th ed. Philadelphia, Lea & Febiger, 1954. 1,480 p. $16.

GRUEBBEL, A. O. How some dentists attain financial security; based on interviews with prominent dentists and financial consultants. Kansas City, Successful Practice Publications, 1954. 29 p. $1.

HARNDT, EWALD. Die Gussfüllung; ihre praktische Durchführung zur Prophylaxe der Zahnkaries und der paradentalen Erkrankungen. 4th ed. Leipzig, Barth, 1953. 87 p.

HUTCHINSON, A. C. Dental and oral x-ray diagnosis. Edinburgh, Livingstone, 1954. 524 p. $15.

JAPAN. MINISTRY OF EDUCATION. Japan science review: medical sciences. v. 1: Abstracts. v. 2: Bibliography. Tokyo, The Ministry, 1953. $13.

KILLIAN, H. & WEESE, H. Die Narkose; ein Lehr- und Handbuch. Stuttgart, Georg Thieme, 1954. 1,003 p.

LANGLEY, L. L. & CHERASKIN, E. The physiology of man. New York, McGraw-Hill, 1954. 609 p. $5.50.

MCDOWELL, FRANK; BROWN, J. B. & FRYER, MINOT. Surgery of the face, mouth, and jaws. St. Louis, Mosby, 1954. 213 p. $6.50.

MARIN, F. V. Del ayer de nuestra profesión. Yauco, Puerto Rico, Rodriguez Lugo, 1953. 144 p.

MAYER, T. A. Bank instalment financing of medical and dental fees. Thesis. Rutgers University, New Brunswick, N. J., 1954. 72 p. Mimeo.

MORLEY, M. E. Cleft palate and speech. 3d ed. Edinburgh, Livingstone, 1954. $4.25.

ORBAN B. J. & WENTZ, F. M. Atlas of clinical pathology of the oral mucous membrane. St. Louis, Mosby, 1955. 135 p. $10.

ORTHODONTIC DIRECTORY OF THE WORLD. 17th ed. Nashville, American Association of Orthodontists, 1954. 217 p. $5.75.

OSBORNE, JOHN & LAMMIE, G. A. Partial dentures. Oxford, Blackwell, 1954. 374 p. $9.50.

PELTON, W. J. & WISAN, J. M. Dentistry in public health. 2d ed. Philadelphia, Saunders, 1955. 282 p. $6.50.

PODOLSKY, EDWARD, ed. Music therapy. New York, Philosophical Library, 1954. 335 p. $6.

SCHWEIZERISCHE ZAHNÄRZTEGESELLSCHAFT. Die zahnärztliche Behandlung des Kindes; Sammelband der Referate und Diskussionvoten am Kongress der Schweizerischen Zahnärztegesellschaft auf dem Bürgenstock, May 15-17, 1953. Berne, The Association, 1953. 176 p.

SHANE, S. M. The practice of balanced anesthesia. Baltimore, Lowry & Volz, 1953. 196 p. $5.75.

SHAPIRO, H. H. Maxillofacial anatomy with practical applications. Philadelphia, Lippincott, 1954. 392 p. $12.

SHAW, J. H. Fluoridation as a public health measure. Washington, American Association for the Advancement of Science, 1954. 232 p. $4.50.

SIEBERTH, PAUL. Tabellen für Kieferorthopädische Behandlung. 3d ed. Leipzig, Barth, 1954. 21 p.

SINGER, CHARLES, ed. A history of technology. v. 1: From early times to fall of ancient empires. Oxford, Clarendon, 1954. 863 p. $23.55.

STRAIN, R. W. Introduction to medicine for dental students. Bristol, John Wright, 1954. 234 p. $3.50.

SWENSON, M. G. & TERKLA, L. G. Partial dentures. St. Louis, Mosby, 1955. 421 p. $12.

THOMA, K. H. Oral pathology; a histological, roentgenological, and clinical study of the diseases of the teeth, jaws, and mouth. 4th ed. St. Louis, Mosby, 1954. 1,536 p. $22.50.

TYLMAN, S. D. Theory and practice of crown and bridge prosthesis. 3d ed. St. Louis, Mosby, 1954. 1,017 p. $16.

U. S. DEPT. OF HEALTH, EDUCATION AND WELFARE. Directory of dental clinics in the U. S., 1954. Washington, U. S. Public Health Service, 1954. 77 p.

U. S. NAVAL MEDICAL SCHOOL, BETHESDA, MARYLAND. Color atlas of pathology: endocrine system including pituitary, thyroid, parathyroid, adrenals, and pancreas. Gynecology and obstetrics including reproductive organs, breasts, male genital tract, skin. Prepared under the auspices of the U. S. Naval Medical School. Philadelphia, Lippincott, 1954. 450 p. $20.

U. S. PUBLIC HEALTH SERVICE. Comprehensive dental care in a group practice; a study of service and time requirements. Washington, Govt. Print. Off., 1954. 48 p. $.25.

THE VIPEHOLM DENTAL CARIES STUDY. Lund, 1954. 194 p. (Reprint from Acta Odontologica Scandinavica, Vol. 11)

WATSON, E. H., & LOWRY, G. H. Growth and development of children. 2d ed. Chicago, Year Book Publishers, 1954. 296 p. $12.

WHITE, T. C. Orthodontics for dental students. London, Staples, 1954. 367 p. $9.

YEARBOOK OF DENTISTRY, 1954-1955. Chicago, The Year Book Publishers, 1955. 464 p. $6.

The American Dental Association Film Library

The Film Library holds weekly previews of dental health and technical films for the purpose of selecting suitable material not only for purchase by the Film Library but also for possible showing at the annual session. Any readers who have recently produced films that depict some phase of diagnosis, treatment or research related to dentistry or to the improvement of dental health are requested to apply to the Film Library for film preview applications.

In January 1955, the Association Film Library began its fourth year of operation with 125 titles, 470 prints, 2,018 individual slides, ten filmstrips and three radio transcriptions as compared with 34 titles, 108 prints, 1,736 slides and three filmstrips which comprised the collection in January 1952. There are now 95 titles on technical subjects for use by professional groups as compared with 14 titles on technical subjects in 1952. In order to insure availability of films, it is suggested that program chairmen plan their programs far enough in advance since the number of prints necessarily is limited.

Of the 1,975 films circulated in 1954, 50 per cent were requested by dental societies, 25 per cent by other professional groups such as dental schools, hospital dental staffs, and armed services personnel, and 25 per cent by elementary and secondary schools, community and civic groups. This is a sharp change from the trend in 1952 when 85 per cent of the 692 films circulated were requested directly by the elementary and secondary schools and only 15 per cent by professional groups. This change did not occur automatically but resulted from a planned program designed to acquaint the dental societies and other professional groups with the audio-visual materials available for their use, the effective way of using them and the need for their increased use in dental programs and in dental education. This has been done through the publication in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION of monthly film reviews and articles on available materials, distribution of Mimeographed lists of audio-visual materials, and through replies to requests from dental societies and other borrowers.

The development of a central source of audio-visual information on dental subjects, equipment, dental film production and cataloging has been continued as an important part of the activities of the Film Library program. The possibilities for development and improvement in the audio-visual education program in the dental field in the United States are still tremendous.

FILMS RECEIVED

The Smallest Foe • 16 mm., color, sound, 19 minutes. Produced in 1954 by Willard Pictures, Inc., for Lederle Laboratories, American Cyanamid Corporation, Pearl River, N. Y. Procurable on loan ($2.50) from the American Dental Association Film Library, 222 E. Superior St., Chicago, and free from the Lederle Laboratories.

Note: One print of this film has been generously deposited on an indefinite loan basis by the Lederle Laboratories. If requests from professional groups become too numerous, they will be referred to Lederle Laboratories.

Technics in virus research and in the manufacture of vaccines used to prevent diseases in men and animals are shown in the Virus Research Building at Lederle Laboratories. (Suitable as a general information film for use by dental societies and other professional groups.)

Surgical Procedures for the Reduction of Abnormal Alveolar Process and Mucosa • 16 mm., color, silent, 45 minutes. Produced in 1954 by Sampson S. Hecht, D.D.S., Times Bldg., 42 St. and Broadway, New York. No copies for sale. Procurable on loan ($2.50) from the American Dental Association Film Library, 222 E. Superior St., Chicago.

Vertical reduction of alveolar ridge, alveolar ridge reduction to increase pontic and clinical crown space, extraction, and reduction of an elongated maxillary segment to improve a ridge for a complete denture, and the reduction of a fibromatous enlargement of tuberosity are shown. (Suitable for prosthodontists, oral surgeons, dental schools, dental societies, dental study clubs, and other professional groups.)

FILM REVIEW

General Anesthesia in Oral Surgery • 16 mm., color, silent, 32 minutes. Produced in 1938, with revisions in 1954, by George W. Christiansen, D.D.S., 415 Fisher Rd., Grosse Pointe 30, Mich. Procurable on loan ($2.50) from the American Dental Association Film Library, 222 E. Superior St., Chicago. For purchase arrangements, write to the producer.

The causes of common errors in the induction and maintenance of anesthesia and methods of preventing them are illustrated. According to the producer, many of the difficulties of producing and maintaining anesthesia in patients undergoing oral surgery result from malposition of the mandible. A mouth prop is used in the demonstration on a patient and on a wet specimen to show the correct procedure. The operator is cautioned not to occlude the nares while adapting the nosepiece. The placing of the pack is then shown on a wet specimen. Treatment of asphyxia and cardiac arrest is illustrated on patients. How catheters are used to maintain patent airways during endotracheal intubation is demonstrated. In the demonstration of the administration of an intravenous anesthetic, the operator is cautioned against its use in office practice where oxygen is not available. The film concludes with a summary outlining the signs, stages and dangers of anesthesia, and methods of resuscitation.

This film is suitable for teaching purposes. The many demonstrations on patients and on wet specimens increase its instructional value. The photography enables the viewer to observe all the procedures clearly. This film will be of especial interest to oral surgeons, although other professional groups, including hospital dental staffs, may find it stimulating program material.

COUNCIL ON DENTAL RESEARCH

Correction of list of certified dental materials

The following material, which complies with the American Dental Association Specification No. 12, was inadvertently omitted from the complete List of Certified Dental Materials which was published in the February 1955 issue of THE JOURNAL.

CERTIFIED DENTURE RESINS (A.D.A. SPECIFICATION NO. 12)

TYPE I, HEAT-CURING

Material	*Form*	*Manufacturer or distributor*
Lucitone	Pink; plastic cake	The L. D. Caulk Co.

BUREAU OF ECONOMIC RESEARCH AND STATISTICS

Survey of recent dental graduates
I. Cost of establishing a practice

Two financial outlays of major proportions are required before a person can enter the private practice of dentistry. The first is the cost of the dental education, and it is followed by the cost of establishing the dental practice.

The cost of establishing a dental practice varies with the price of equipment and the amount and type of equipment purchased. Prices of dental equipment, like prices generally, have risen in recent years. The trend toward more multiple-chair offices has raised the average cost of equipping dental offices. A piece of equipment now popular that was not in existence a few years ago is the operating stool.

The main purpose of this survey is to determine the cost of establishing a dental practice and the amount of dental equipment purchased. The amounts paid for existing practices will also be presented. Other subjects covered in this survey are the reasons why dentists select or reject towns as practice locations, amount of time elapsing between graduation and licensure and between licensure and start of practice, and rate of development of the typical dental practice.

Questionnaires were sent in November 1954 to all dentists who graduated during the period 1951 through 1954, with the exception of dentists in the federal dental services. Of the 8,466 questionnaires sent out, 3,490, or 41 per cent, had been returned by the cut-off date. Inasmuch as the main topic of the survey is the cost of establishing a private practice, the analysis includes only the 2,865 dentists in nonsalaried private practice.

Of the 625 dentists excluded from the analysis, 292 were employed by another dentist and received either a salary or a percentage of fees, 141 were interns, residents or graduate students, 53 were employed by the state, county or city, and 47 were teachers. Fifty-eight were in the Armed Forces and were included on the mailing list because of the inevitable time lag in reporting change of address. There were several other categories of dentists not in private practice, including four who were studying medicine, four industrial dentists, and seven either waiting to take the state board examination or waiting to go into military service.

As shown in Table 1, dentists who graduated during the period 1951 through 1954 spent, on the average, $5,870 for dental equipment. This includes only the cost of operating room and laboratory equipment, exclusive of finance charges.

The amount expended for dental equipment increased with the number of years elapsed since the dentist began practicing. Those who had begun practicing in 1954 averaged $5,385; 1953, $5,723; 1952, $6,083, and 1951, $6,308. It is apparent that the typical dentist adds to his initial equipment during the years immediately following the opening of his office.

Table 1 shows the variation in average expenditure for dental equipment and for other items of expense incurred in establishing a practice, according to region of the country. Highest average expenditure for dental equipment was in the Far West ($7,209), followed by the Southeast ($6,424), Southwest ($6,125), Northwest ($6,122), New England ($5,457), Central ($5,299), and the Middle East ($5,111). This ranking is the same as the ranking of regions with respect to

Table 1 • Mean amounts spent for specified items in establishing a dental practice, and percentage of dentists reporting expenditures for specified items, by region

Region	Dental equipment		Dental supplies		Furnishing reception room		Business equipment		Wiring and plumbing		Partitioning		Air conditioning		Other expense		Total expense
	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	
New England	$5,457	98.9	$576	99.4	$315	88.2	$175	89.5	$409	81.2	$248	56.4	$168	44.8	$123	50.3	$7,471
Middle East	5,111	99.8	529	98.5	298	89.6	190	94.3	366	73.2	256	48.1	230	54.7	111	42.6	7,091
Southeast	6,424	97.1	505	96.9	295	86.4	196	90.2	327	70.9	259	43.5	416	59.8	89	38.6	8,511
Southwest	6,125	97.0	529	98.0	271	82.8	252	94.4	325	61.9	212	31.9	322	43.8	178	39.8	8,214
Central	5,299	98.8	448	98.1	215	82.4	191	90.8	249	66.2	179	37.6	193	46.4	112	41.0	6,886
Northwest	6,122	97.8	534	96.8	214	76.1	210	89.7	234	66.1	181	35.3	138	28.6	105	34.0	7,738
Far West	7,209	98.5	704	97.6	324	81.3	276	89.8	150	51.0	111	19.6	63	11.5	135	42.9	8,972
United States	5,870	98.4	530	97.9	270	84.1	208	91.2	283	66.8	203	38.6	222	43.3	115	41.1	7,701

net income as reported in the 1953 Survey of Dental Practice, except that the positions of the New England and Central regions are reversed.

Expenditures according to size of city are shown in Table 2. Average expenditure for dental equipment was highest in cities of 2,500 to 25,000 population ($6,114), and lowest in cities of over 1,000,000 population ($4,937).

The average cost of dental supplies purchased to start a dental practice was $530. Respondents were told to omit expenditures for additional or replacement supplies purchased after the first month in the office.

An average of between $200 and $300 was spent for each of the following items: furnishing the reception room, business equipment, special wiring and plumbing, special partitioning, and air conditioning. The averages given are based on all respondents, including those with no expenditures for the items listed. The mean for those who did have such expenditures can be obtained by dividing the average for a given item by the proportion reporting expenditures for that item. For example, dividing the average expenditure for air conditioning equipment, $222, by the proportion who reported having purchased such equipment, .433, reveals that the average expenditure for those who purchased air conditioning equipment was $513.

There was more regional variation in

Table 2 • Mean amounts spent for specified items in establishing a dental practice, and percentage of dentists reporting expenditures for specified items, by size of city

Size of city	Dental equipment		Dental supplies		Furnishing reception room		Business equipment		Wiring and plumbing		Partitioning		Air conditioning		Other expense		Total expense
	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	
Under 2,500	$5,703	98.4	$513	97.9	$218	83.0	$175	92.0	$190	62.8	$167	33.6	$192	43.6	$122	41.2	$7,280
2,500–25,000	6,114	99.0	561	98.5	262	87.5	208	93.7	273	67.4	221	42.2	226	45.2	115	40.2	7,980
25,000–100,000	5,834	98.6	520	97.8	283	84.0	214	88.5	337	70.2	240	42.1	241	42.6	119	42.4	7,788
100,000–1,000,000	5,856	97.8	509	97.9	292	81.5	226	90.2	280	64.9	176	33.5	205	38.8	118	42.3	7,662
Over 1,000,000	4,937	97.8	498	94.1	252	77.0	176	89.0	300	63.0	145	34.1	229	50.3	90	39.5	6,627
United States	5,870	98.4	530	97.9	270	84.1	208	91.2	283	66.8	203	38.6	222	43.3	115	41.1	7,701

Table 3 • Percentage distribution of dentists by amount spent for dental equipment

Amount	Per cent of dentists
0	1.6
$ 100–$ 999	1.2
$ 1,000–$1,999	1.6
$ 2,000–$2,999	4.5
$ 3,000–$3,999	8.9
$ 4,000–$4,999	14.8
$ 5,000–$5,999	21.5
$ 6,000–$6,999	16.3
$ 7,000–$7,999	9.1
$ 8,000–$8,999	7.7
$ 9,000–$9,999	4.4
$10,000–	8.4
Total	100.0

expenditures for air conditioning equipment than in other items of expense. Highest average expenditures were in the Southeast ($416) and the Southwest ($322). The percentage of dentists buying air conditioning equipment in the Southwest was lower than in some of the cooler regions. A possible explanation is that more of the dental offices in the Southwest region were already equipped with air conditioners, making purchase by the dentist unnecessary.

About two thirds (66.8 per cent) of all dentists were required to pay for special wiring and plumbing, and more than one third (38.6 per cent) reported expenses for special partitioning. Expenditures for furnishing the reception room were reported by 84.1 per cent and for business equipment by 91.2 per cent.

Total expenditures for establishing the dental office averaged $7,701. This figure varied from a high of $8,972 in the Far West to a low of $6,886 in the Central region. By city size, the figure varied from $7,980 in cities of between 2,500 and 25,000 population to $6,627 in cities of over 1,000,000 population.

The variation in expenditures for dental equipment is shown in Table 3. Some of the amounts appear too low to cover the cost of minimum requirements. Two possible explanations are (1) the purchase of second-hand equipment and (2) receipt of items of equipment as a gift, usually from the dentist's father.

Among all respondents, 13.9 per cent indicated they had purchased established practices. In three regions this percentage varied considerably from the national average: New England (6.4 per cent), Southeast (8.1 per cent), and Central (20.0 per cent).

The mean purchase price for established practices was $4,634 (Table 4). No information was obtained as to the completeness of dental equipment and supplies included in practices purchased. Undoubtedly supplementary purchases were necessary in many cases.

Among all dentists who purchased

Table 4 • Mean purchase price for established practices, and mean amount paid for good will, according to region

Region	Mean purchase price	Mean amount paid for good will		Per cent who paid for good will
		Among all who purchased practices	Among those who paid for good will	
New England and Middle East	$4,721	$1,322	$1,786	74.0
Southeast and Southwest	5,740	751	1,742	43.1
Central	4,146	723	1,356	53.3
Northwest and Far West	4,543	772	1,418	54.4
United States	4,634	854	1,514	56.4

Table 5 • Percentage distribution of dentists who purchased established practices, according to total amount paid for the practice

Amount paid for practice	Per cent of dentists
$ 100–$ 999	4.8
$ 1,000–$1,999	13.8
$ 2,000–$2,999	16.8
$ 3,000–$3,999	16.0
$ 4,000–$4,999	12.0
$ 5,000–$5,999	10.3
$ 6,000–$6,999	7.5
$ 7,000–$7,999	5.2
$ 8,000–$8,999	3.8
$ 9,000–$9,999	1.3
$10,000–	8.5
Total	100.0

Table 6 • Percentage distribution of dentists who purchased established practices, according to amount paid for good will

Amount paid for good will	Per cent of dentists
0	43.6
$ 100–$ 499	8.5
$ 500–$ 999	11.0
$1,000–$1,499	12.5
$1,500–$1,999	7.3
$2,000–$2,499	7.8
$2,500–$2,999	3.2
$3,000–$3,499	1.8
$3,500–	4.3
Total	100.0

established practices, an average of $854 was paid for good will. Of the dentists who purchased practices, 56.4 per cent paid for good will. The dentists who paid for good will paid an average total price of $4,870 for the practices they purchased, of which $1,514, or 31.1 per cent, was for good will.

Payment for the intangible factor was considerably more common in New England and the Middle East, where 74.0 per cent of the dentists who purchased practices paid for good will, than in other regions, and was least common in the Southeast and Southwest (43.1 per cent).

The variation in amounts paid for established practices, and in amounts paid for good will, is shown in Tables 5 and 6.

The next article in this series, dealing with the amount and type of equipment purchased, will appear in a subsequent issue of THE JOURNAL.

B. Duane Moen, Director

COUNCIL ON LEGISLATION

Statement to Congress on proposed budget for Public Health Service dental activities

On February 28, Floyd W. Pillars of Des Moines, Iowa, a member of the Council on Legislation, submitted a written statement to Congress presenting the Association's views on the proposed appropriations for the dental activities of the Public Health Service. The statement was submitted to a subcommittee of the House Appropriations Committee headed by Rep. John E. Fogarty of Rhode Island. The statement

emphasized the importance of increased federal support for dental research activities administered by the National Institute of Dental Research. The Council on Legislation requested that the proposed Public Health Service dental research grants for fiscal year 1956 be increased from $421,000 to $1,000,000 and the dental fellowship grants from $100,000 to $250,000. The Council also urged again that Congress appropriate the funds necessary for construction of a building to house the National Institute of Dental Research. Congress authorized that construction in 1948 but has not yet appropriated the necessary funds. The text of the Council's statement follows.

As a professional group organized primarily to improve the dental health of the public, the American Dental Association with the complete support of its membership has devoted its major resources to assist in the development of methods for preventing dental diseases and disorders. Each year, for example, the Association spends about $220,000 in support of dental research. Additionally, the efforts of three of the important Association agencies, the Councils on Dental Research, Dental Therapeutics, and Dental Health, are spent mainly in furthering preventive dentistry and dental research.

The successful efforts in the prevention of human diseases, particularly the communicable diseases, have invariably resulted from research. The Association is convinced that the successful attack upon dental disease, the most prevalent of human ailments, must also depend ultimately on effective methods of prevention, especially mass methods as a dental public health function. That goal can only be achieved through an intensive and expanded dental research program. The federal government has justifiably contributed a considerable portion of its resources in support of health research activities. Dental research support from the federal government, however, although steadily increasing each year, does not represent by any measure an adequate appreciation of the nation's dental health problem, nor the tremendous cost of dental treatment borne by the public and the federal, state, and local governments.

This committee has heard the testimony of the Public Health Service dental representative. That presentation emphasized, as the Association has emphasized in past appearances before this committee, that approximately one of every six dollars spent annually for health care is for dental care. The federal government, moreover, spends at least 100 million dollars annually for the dental care of its beneficiaries; in contrast, it will have spent only a little more than 2 million dollars for its dental research activities during fiscal year 1955.

There are two dental appropriation items in the Public Health Service budget which especially merit substantial increases. They are the funds to be appropriated for extramural dental research projects, known as research grants, and the funds to support essential training of young scientists, known as fellowship grants. The amounts proposed for these two items for fiscal year 1956 are the same as the appropriations for fiscal year 1955: grants for dental research and training projects—$421,000, and grants for dental research and training fellowships—$100,000. The American Dental Association recommends that 1 million dollars be appropriated as grants for extramural dental research projects and $250,000 for dental fellowships.

Last year the Association urged increases for the extramural dental research project and dental fellowship programs. Congress responded by appropriating $250,000 more for those programs than was requested by the asking agency. Those funds ($521,000) have been spent or will be committed before the end of this fiscal year. The Association has been informed, moreover, that a large number of worthy dental research projects, for which grant applications have been received, must be held in abeyance until additional funds become available. Reports from the dental schools alone would indicate that the additional dental research funds requested by the Association will be needed during fiscal year 1956. The American Dental Association urges this committee and Congress to provide an additional $579,000 in dental research grants to assure that every dental research project approved by the National Advisory Dental Research Council of the U. S. Public Health Service during fiscal year 1956 will be undertaken.

The need for further research into all types of dental disease is clearly evidenced by the present lack of knowledge of the basic causes of human dental disorders. The history of medical research discloses clearly that successful investigations of the cause of disease require not only the well trained minds of men,

but also a spirit of dedication. Research into the basic causes of disease of any type is usually the life work of many highly trained scientists. Dental research is sorely in need of more scientists who will be willing to dedicate their careers to investigations into the causes of dental disease. The federal government can do much to stimulate the interest of young scientists and students in dental research. The dental fellowship grants sponsored by the National Institutes of Health have already contributed immeasurably toward that objective. The number of dental research projects reported by the International Association of Dental Research, for example, has almost trebled since 1950. That healthy expansion of dental research activity reflects to a great extent the success of the federal government's dental fellowship program. An additional $150,000 in dental fellowship grants for fiscal year 1956 will assure that the progressively increasing interest of young scientists in dental research will be supported. Without that modest increase, the dental fellowship program will be practically stabilized at its present level.

The American Dental Association is also vitally concerned with the research activities conducted by the permanent staff of scientists at the National Institute of Dental Research. A measure of that interest is reflected annually in the Association's expenditures. In 1954, for example, the Association spent about $30,000 to support the American Dental Association Research Fellowship at the National Institutes of Health. The Association has sponsored that fellowship each year since 1941.

The dental research activities of the National Institute of Dental Research, in the Association's opinion, have outgrown their facilities. There appears to be no plausible reason for any further delay in the construction of a building to house the dental institute. Congress in 1948 authorized appropriations for the dental research building. Although $100,000 of that authorization has been expended for the building plans, nothing further has been done to carry out the intent of Congress. The remainder of the authorization, $1,900,000, unfortunately would not be sufficient today to construct the building according to the plans as already drawn. It is estimated that the building as specified in the plans would cost at least 33 per cent more to construct today than in 1948-49.

Within the budget of the Public Health Service, under miscellaneous items, there is an item identified as "Unfinished contract authorization." It represents an appropriation of approximately $1,500,000, which will not be needed for the construction of the clinical research facilities at the National Institutes of Health. In fact, the Public Health Service indicates in its budgetary explanation that the major construction of research facilities is practically completed. The American Dental Association recommends that this committee and Congress appropriate the $1,900,000 already authorized by Congress for the dental institute building and as much of the $1,500,000 in construction authorization proposed to be canceled at the end of this fiscal year as will be required to construct the dental institute building according to the authorized and prepared plans.

In summary, then, the American Dental Association submits the following recommendations to the Subcommittee on Labor, Health, Education, and Welfare of the Committee on Appropriations:

1. An increase in the appropriations for grants for dental research projects from $421,000 to 1 million dollars.

2. An increase in the appropriations for grants for dental research fellowships from $100,000 to $250,000.

3. The appropriation of $1,900,000 already authorized by Congress for a building to house the National Institute of Dental Research, plus a portion of the $1,500,000 appropriated, but not needed for the clinical research facilities sufficient to construct the dental institute building according to the authorized and completed plans.

In behalf of the American Dental Association, I wish to thank the committee for the opportunity of presenting the Association's views and recommendations on the appropriations for the dental activities of the U. S. Public Health Service.

APRIL 1955

LON W. MORREY, D.D.S., EDITOR
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Editorials

Threat of atomic warfare demands dentists' participation in civil defense

This government's recent disclosures of the potential danger of a radioactive fall out; Britain's plans to make hydrogen bombs of its own; Russia's boast that it has outdistanced others in the race for nuclear weapons; the President's plea for a one hundred and one billion dollar highway program which will facilitate the exodus of citizens from areas threatened with atomic attack; hints that guided intercontinental supermissiles are in the making; more nuclear fusion tests at Yucca Flats and the fingerprinting of Lake Charles, Louisiana, school children by the local Civilian Defense Committee—all these are straws in the wind—an ill wind that blows coldly across the earth keeping alive the embers of world discord and distrust. Certainly such incidents repeated with increasing frequency are indicative of the serious trend in world affairs. Daily it becomes more apparent that the leaders of this and other nations do not discount the possibility of another world war, nor do they discount the possibility that nuclear action weapons will be used should a third world war arise.

In such an eventuality civilians, even more perhaps than the military, will become the targets of the attacker—a fact recognized since the first atomic bomb was dropped upon Hiroshima. For four years the United States has had in operation a Civil Defense Administration charged with the responsibility of establishing a civil defense mechanism which can be thrown into action in time of need. Except for a plane detection program, however, in which some four million volunteers are enrolled, civilian defense plans remain largely on paper. True, some efforts have been made in some communities to establish a workable organization to handle the havoc of an atomic disaster, and in those communities the services of the dentist rank high in their organization chart.

In 1951 this Association appointed a Civil Defense Committee, a subcommittee of the Council on Federal Dental Services. Working closely with Russell W. Bunting, dental consultant to F.C.D.A., this special committee has succeeded, despite public and professional apathy, in persuading a number of dental societies to participate in their community defense planning. That all members of the profession do not share the nation's general indifference to the defense program is evidenced by the fact that 67 dentists from 24 states attended a three-day civil defense course given at the F.C.D.A. staff college in Olney, Maryland, last May, and 76 dentists from 16 states enrolled for the second course in February of this year.

Despite the best efforts of the civil defense committee of the Association and of F.C.D.A. dental consultant Bunting, interest in the dental aspects of the nation's defense program is as tepid as interest in its other phases. In the words of Representative Chet Holifield (D., Calif.) "We do not have today, and there is little prospect of our having, the bare minimum of protection our cities and industries would need to keep a nuclear Pearl Harbor from dealing us a terrible, possibly mortal blow."

Although it is fervently hoped that this country never will need the services of a civilian defense medical team, it seems foolhardy, in light of present trends, for the nation and the nation's dentists to refuse to face facts. The tremendous casualty load which a community will have to bear in the event of an atomic war, and the uncertainty as to where an atomic or hydrogen bomb may drop, make it imperative that every community which may be a potential target be prepared to use to the fullest its medical and related resources in the event of disaster.

Members of the dental profession will not, indeed dare not, shirk their obligation to their fellow citizens by neglecting to prepare themselves for the responsibilities which would be thrust upon them in the event of an atomic attack. It is hoped that many more defense-minded dentists will follow the example set by the 143 farsighted pioneers who enrolled in the two original civil defense courses. Information as to how to participate in the nation's civil defense program can be obtained from Russell W. Bunting, Dental Consultant, Federal Civil Defense Administration, Battle Creek, Michigan, or from Carl L. Sebelius, Chairman, Subcommittee on Civil Defense, American Dental Association, 222 East Superior Street, Chicago.

Dentists invited to join American-Korean Foundation

During the next few weeks members of the Association will be given an opportunity to participate in the rehabilitation of dentistry in Korea. Daniel F. Lynch, president of the Association, and Oren A. Oliver, chairman of the Association's Council on International Relations, personally are inviting the dentists of this country, on behalf of the American-Korean Foundation, to join once more in this worthy international humanitarian effort.

Four years of war brought disaster to the healing professions in Korea. The country's lone dental college was demolished, its dentists were decimated and its

dental services reduced to an irreducible minimum. Only by heroic efforts can dentistry there be brought back to some semblance of normalcy and its people be provided with something more than rudimentary dental care.

American dentists can be proud of the part they have played so far in the restoration of Korean dental health service. Last year they contributed more than 50,000 pounds of dental supplies and equipment which the American-Korean Foundation delivered to Seoul National University College of Dentistry and to outlying provincial dental clinics. Additionally the American-Korean Foundation is helping Korean dentistry in other ways—by sending teachers to American dental schools for advanced training—by subsidizing a Korean dental journal and by reconstructing a program of dental service.

But the job of re-establishing Korean dentistry is far from completed. More supplies, more facilities and more and better trained dentists are needed before the Korean people can be furnished the dental service they sorely need.

It is hoped that every member of the Association will live up to the profession's established reputation for generosity and humanitarianism by responding promptly and wholeheartedly to the invitation of President Lynch and Chairman Oliver to join the American-Korean Foundation.

The dentist mans the front lines in the fight against cancer

Cancer strikes one in four today, the American Cancer Society reports. Of every 16 people, four will have cancer; of these four, one is saved, one dies who could have been saved by earlier diagnosis and two die of types of cancer that future research may control.

The National Cancer Institute has estimated[1] that roughly 15 per cent of all cancer diagnosed each year falls within the purview of the dentist. In 90 per cent of all the lesions that occur in the oral region, the dentist is the first to have the chance to detect them.[2] By the nature of his profession and the conditions of his daily practice, the dentist is in a singularly effective position to decrease the death rate of cancer. Dentistry must make the most of its opportunity.

The dentist is in a position to examine directly and easily the whole mouth and to see and check the mouths of many patients. Because dental diseases usually do not incapacitate, the dentist examines far more "well" persons than does any other person in the health field. The dentist views the membrane of the oral cavity under excellent lighting conditions. He explores a sufficient number of mouths so that he will automatically detect slight departures from the normal. A suspicious attitude toward questionable deviations and insistence upon biopsy and appropriate treatment can be an inestimable boon. Early detection may mean prevention of inoperable cancer. A careful dental examination can reveal an early carcinoma which is unknown to the patient because it causes neither pain nor other warning symptoms. Diagnosing, or even suspecting, a malignant lesion when it is in the early stages of its growth permits the mobilization of all available therapeutic measures.

To play his part in the program of detecting cancer in its early stages, every dentist must acquaint himself with cancer diagnosis. He should be able to recognize the various types of lesions that may be cancerous and those that definitely are not; he should know the precancerous conditions to suspect, and where to look for them.

Practically all dental schools are participating in the teaching program on oral cancer. Dentists, to maintain and improve their skills in the anti-cancer fight, may utilize postgraduate courses, discussions at society and association monthly and annual meetings, dental journals, and films and other visual aids. One training aid is the film "Cancer of the Oral Cavity"[3] produced in 1954 by the American Cancer Society and the Columbia Broadcasting System. This 60 minute sound film discusses the manifestations of oral cancer and the role of the dentist in its recognition. The film is procurable on loan from the American Dental Association's Film Library.

Not only can the dentist render the priceless service of detecting early cancer in the mouths of afflicted patients, he can also contribute to the well-being of patients by allaying cancerophobia among those who may be disturbed by one of the many non-pathological variations of the normal in their mouths. The dentist who can reduce such cancerophobia by explanation and assurance is performing a further beneficial health service in the fight against cancer.

1. Kaiser, Raymond F. General comments on the cancer teaching program in dental schools. J. D. Educ. 18:18 Jan. 1954.
2. Pinckney, Edward R. Role of the dentist in the detection of nondental disease. J.A.D.A. 50:185 Feb. 1955.
3. Bureau of Library and Indexing Service. Film review. J.A.D.A. 50:337 March 1955.

Needed: an improved method of instrument sterilization

That the inventive geniuses of dentistry are constant in their efforts to improve the profession's operating instruments is again evidenced in this month's issue of THE JOURNAL which contains six reports on the newer tooth cutting devices, presented at the ninety-fifth annual session of the Association last November. Peyton's evaluation of handpieces for high speed operations; Hudson's observations on the characteristics of rotating instruments; Black's revaluation of the air abrasive technic and reports by Nielsen and Oman on ultrasonics open new vistas in operative dentistry. Some of these reports deal with devices still in the experimental stage; some, with devices which, although new, have proved their worth and become standard in many practices.

The success which researchers have achieved in developing better cutting instruments prompts the suggestion that these or other ingenious gentlemen direct some of their time and talents toward the development of more effective methods of instrument sterilization. Certain current methods of sterilization injure the cutting edges of instruments and the bearing surfaces of handpieces. One of the great needs of dentistry today is a method of sterilization that is swift, safe and sure—and surely among those who were clever enough to revolutionize operative procedures there are those adroit enough to revolutionize other methods so as to assure the ultimate in instrument sterilization.

The Reader Comments

THE JOURNAL *devotes this section to comment by readers on topics of current interest to dentistry. The editor reserves the right to edit all communications to fit available space and requires that all letters be signed. At the request of the author, signatures will be deleted before publication. Printed communications do not necessarily reflect the opinion or official policy of the Association. Your participation in this section is invited.*

The Editor

ITINERANT SALESMEN

Recent experience with an itinerant salesman has convinced me of the folly of dealing with people with whom one is not familiar. About a year ago a salesman came to my office unannounced during a busy afternoon and, finding my resistance low, sold me a "demonstration articulator." Being only partially convinced, I placed a deposit and promised to send the remainder. I found shortly that the articulator was of no value to me and returned it to him requesting my deposit. I am still requesting. In our last communication I was informed that the receipt which I signed was a contract which stated that no returns would be accepted and no refunds would be made.

Ten years of dealing with reliable accommodating dental firms made me an easy mark for this type of sharpie. I hope others can benefit from my experience and will think carefully before dealing with individuals who are not well known to them.

Alan Jackson, Miami, Fla.

THE USE OF ACRYLIC RESINS

For the last 50 years the dental profession has been waiting for a suitable material to be used in anterior teeth for the restoration of tooth structure lost as a result of disease or accident. The public's demand for an enamel-like substance has been overwhelming, and the dental profession has succumbed to the pressure. Whenever an announcement is made by a dental manufacturer of the discovery of such material the race is on. Without waiting for these materials to be tested by properly constituted investigating bodies such as we have, many practitioners eagerly begin to use them.

Many have abandoned the use of highly acceptable gold foil so that it appears that the whole field of gold foil restorations is a lost art. The silicate cements and the acrylic resins which we have accepted as substitutes are not an improvement. Competent investigators have found that these materials are not harmless. (See "Pulp Reaction to Direct Filling Resins," by B. Nygaard-Ostby, THE JOURNAL, Jan. 1955.) The indiscriminate use of untested and unapproved materials and methods is not helping to reduce the ravages of dental decay.

There ought to be some authority to examine the claims of manufacturers, to test and report on the validity of those claims prior to the offering of these materials to the dental profession. Such procedure would protect the good name of the profession and the interest of the public.

S. P. Ratner, Long Island City, N. Y.

Editor's note • As Dr. Ratner states, there have been many articles published on the physical properties and the effect of acrylic direct filling resins on tooth pulp. Some investigators believe there is little or no effect; others believe there is a great deal. For contrary views see the article cited by Dr. Ratner and also "Evolution of Acrylic Resin as a Restorative Material," by H. D. Coy, THE JOURNAL, March 1954. Researchers at the National Bureau of Standards report that no single case of pulp death has occurred in the more than 100 restorations placed in their experimental clinic.

It is agreed that when a new material is put on the market it should be tried out by dentists only in an experimental fashion. Unfortunately many dentists use such materials for the first time in the mouths of their patients without first experimenting with the material in or on extracted teeth. Also, unfortunately, far too many dentists pay no attention to the directions accompanying the package but mix the direct acrylic resin filling materials as they do the silicate cements. Certainly the dentist should be more discriminating in using and more skeptical in procuring new materials.

Over the opposition of the Veterans Administration and the American Dental Association, Rep. George S. Long (D., La.) is attempting to gain enactment of legislation that would greatly increase veterans' dental care at government expense.

One of the first things Representative Long did after being named chairman of a House subcommittee on veterans' health services and hospitalization was to schedule a hearing before the subcommittee on his bill (HR 4481) authorizing expansion of dental benefits. The bill seeks to restore a policy whereby a beneficiary may receive virtually unlimited care and extends his eligibility for a two year period following military discharge.

Present law requires that application for dental care be made within one year from the date of discharge. And, by administrative order, services rendered are on a one-time completion basis, with recurring treatments prohibited.

"I feel that this bill (HR 4481) is fair, both to the veteran and to the Government," Representative Long stated. "I realize it is a hard problem to work out, but I have gone into it after careful study and I feel that my education as a dentist qualifies me to write such a bill."

On the other hand, the VA's position as expressed at the subcommittee hearing was that continuation of the one year deadline and provision of care on a one-time completion basis "reflect generally a sound and proper evaluation of the Government's dental program for veterans."

It was pointed out that the prospective budget for the fiscal year beginning July 1, 1955, allocates $11,500,000 for outpatient dental care. This sum is predicated on retention of the one year cutoff and the one-time completion procedure. Enactment of the Long bill would necessitate a $43,039,000 appropriation, according to the VA.

Rudolph H. Friedrich, secretary of the American Dental Association Council on Dental Health, presented organized dentistry's case against the bill. He urged favorable action on the Frelinghuysen bill (HR 1793), which would give statutory sanction to existing limitations on outpatient dental care.

The following are members of the House Veterans Affairs subcommittee on health and hospitals legislation, of which Representative Long is chairman:

Democrats—Reps. Leo W. O'Brien (N.Y.), B. F. Sisk (Calif.); Republicans—B. W. Kearney (N.Y.), William H. Avery (Kas.).

AID TO EDUCATION

All signs point to increasing support on Capitol Hill of legislation designed to assist schools of medicine and dentistry by means of federal grants for physical expansion and improvement. Three influential Congress members favor aid of this kind, which is comparable to the government's nine year old system of matching construction grants to hospitals.

Bills which have been introduced so far by Sen. Lister Hill (D., Ala.) and Rep. J. Percy Priest (D., Tenn.) provide grants for medical schools exclusively. It is known, however, that they are willing to amend their bills so as to take in schools of dentistry. A bill introduced subsequently, on March 7, by Rep. John E. Fogarty (D., R.I.) contains provisions for aid to dental schools.

Senator Hill is chairman of the Senate Labor and Public Welfare Committee, which will consider his aid-to-education measure. Representative Priest is chairman of the House Interstate and Foreign Commerce Committee, which will handle

the identical companion bill. Representative Fogarty also holds a pivotal position; he is chairman of the appropriations subcommittee which processes the annual budget of the Department of Health, Education and Welfare. Since the proposed grants program would be administered by the U. S. Public Health Service, of which the Department of Health, Education and Welfare is a part, the importance of Representative Fogarty's role is obvious.

His bill authorizes $250,000,000 over a five year period for grants to medical schools and $50,000,000 ($10,000,000 annually) to schools of dentistry. Recipient institutions would have to match the grants dollar for dollar. However, they could receive two dollars for one if (1) the assistance was required for the establishment of a new school, or (2) satisfactory assurance was given—in the case of an existing school—that financial aid would result in at least a 5 per cent increase in freshman enrollment.

Provisions of the Hill and Priest bills are the same, save that they do not include dental schools in the program.

"None of us can afford to allow medicine and dentistry to become professions only for the well-to-do, and it is rapidly approaching that position," said Representative Fogarty, stressing high tuition fees and financial difficulties of professional schools.

"Isn't it time that the federal government recognize this situation and participate in helping in its solution?" he asked. "It would seem that the logical place to participate is by giving assistance in modernizing and providing for the necessary additions. . . . This bill is patterned after the Hill-Burton Construction Act with similar provisions and safeguards. I feel it will help assure the very necessary supply of carefully prepared physicians and dentists for our medical care and teachers and scientists to carry on the fine tradition of our medical and dental schools."

O.A.S.I. FOR DENTISTS

The Senate's senior Republican, Styles Bridges of New Hampshire, and Rep. Paul F. Schenck (R., Ohio) are sponsors of newly introduced bills designed to bring self-employed dentists under O.A.S.I.

The Bridges bill was referred to the Senate Finance Committee and Representative Schenck's to the House Ways and Means Committee.

NEWS FROM GREAT BRITAIN

The similarity of thought and action between the United States of America and Great Britain is a well-known fact, and for this reason it is somewhat surprising that there should be a wide division of public opinion in the two countries in regard to dentistry, writes W. Stewart Ross. In the United States the dental schools have a full quota of dental students, while in Great Britain many schools are lamentably short. THE JOURNAL has already noted that there will be a drop of something like 5,000 in the number of dentists on the Register in ten years, if the present situation continues. It is with satisfaction, therefore, that we record that the Minister of Health, Mr. Iain Macleod, has announced in the House of Commons that an interdepartmental committee will be set up to ascertain the reasons for the lack of candidates and to indicate possible remedies. This decision comes as a result of representations from the British Dental Association, which takes a most serious view of the situation.

The British Dental Association and the Ministry of Health throughout the last six years have not always seen eye to eye, but everyone who has the dental profession at heart in Great Britain will welcome the following words from the Minister of Health:

"My personal relationships and those of my Ministry with the dental profession are closer and friendlier than ever before. I am delighted at that and delighted at the leadership that is coming from the British Dental Association in face of a variety of attacks not always well informed."

PROBLEMS OF RECRUITMENT

Sir Wilfred Fish gives his views on the problem of recruitment to dentistry, which he says is at least being tackled. That recruitment has not been tackled before is really nobody's fault. The Dental Board which was empowered to raise a levy on all dentists by the Act of 1921, was charged also to spend any surplus funds studying problems of recruitment. Even in 1921 it was realized that there was going to be a shortage since more than half the men put on the 1921 Register had no academic qualification. It follows, therefore, that as they retired or died, they were not replaced. If, however, we look at those who held an academic qualification, we see a picture of remarkable progress.

In 1878 there were only 500 academically qualified dentists and four licensing bodies. By 1921, there were 7,000 graduates or licentiates and 15 licensing bodies. Now there are nearly 12,000 academically qualified dentists and 18 licensing bodies. This later development is in no small measure due to the dentists themselves who contributed through the Dental Board some two and a half million dollars to be spent on undergraduate education between the wars. The trouble arises because the government has said that everyone is entitled to free dentistry "so far as it is available" and, although the government has had to amend this position considerably, the moral obligation remains for it to make sure that there are enough dentists.

Dental care is so popular—despite opinion to the contrary—that there are by no means enough dentists if dentistry is made free for all, and the government had to reimpose a charge to stop the stampede. It is in the interest of both sides—not to say to the benefit of the man in the street—that everybody co-operate in solving the numerous and baffling problems that this entirely artificial demand on the profession has created.

Therefore, the Association had asked the ministers to set up an interdepartmental committee to enquire into the cause of the shortage of dental manpower, and the Ministers have agreed to do this.

In the meantime the Dental Board has delayed taking action only because it has been expecting a new dental bill which would appoint a dental council to supersede it. Now that the bill seems to be far off, the Board has decided to develop a program to stimulate recruiting and has allocated £50,000 to be spent in the next five years on the campaign. Just as an artificial demand has been produced, so must an artificial remedy be found.

The Faculty of Dental Surgery in the Royal College of Surgeons is coming to grips with the problem of setting up the dental science and research department. Some £250,000 ($700,000) is needed to endow the department; however, £100,000 would ensure seven years of unencumbered activity. It is hoped that this time next year facilities will be built.

The program of research is already mapped out. Research into the collagen system will occupy the team, which will consist of a histopathologist, a bacteriologist and a biochemist,

together with a number of junior fellows at the College. The anatomy, physiology, pathology and biochemistry departments of the College are all in close association, and dentistry, which is almost wholly concerned with the collagen system of the body, should have a major contribution to make. Naturally there will be sidelines, and no problem of investigation will be barred unless it is of a directly clinical nature for which type of study there are no facilities at the College. Fundamental research will be stressed, and there will be personal contacts with St. Mary's Hospital and the department there in which Sir Alexander Fleming discovered penicillin.

ITEMS OF INTEREST

Many dental practitioners were expecting that Her Majesty might have mentioned the new dental bill in her recent speech to Parliament, reports Cyril de Vere Green. This, however, was not the case, and the omission is being taken to mean that the bill has been shelved again. The bill would affect the profession of this country, for among other provisions, it would grant the profession autonomy, which the profession does not at the present possess; it would sanction an experimental scheme for the training and use of dental ancillaries in the conservation of children's teeth, and it would recognize the academic status of dental degrees given by certain examining bodies outside the United Kingdom.

The winter session of dental meetings is in full swing, and the number of members attending the monthly dinners of the American Dental Society of London are well up to average, though it has been noted that fewer United States Service dental officers have been attending this session.

During January, Professor Skinner of Northwestern University gave a public lecture on alginates and hydrocolloids at the Postgraduate Eastman Institute of Dental Surgery. Visiting lecturers from the United States are always welcome in Great Britain, and Professor Skinner has left many friends behind him in Scotland and in England.

The metropolitan branch of the British Dental Association held its annual clinical meeting last December. This was organized by Cyril de Vere Green, and in the writer's opinion, was probably the best clinical meeting of the past year in the United Kingdom. A few of the high lights were: "Chairside Microscopy by the Phase Contrast Method" (J. Bunyan), showing a most accurate and instructive method of immediate diagnosis by examination of living organisms; "Implant Dentures" (B. Trainin), showing results of the use of Virilium implants; "Some Experiments with a New Resilient Plastic Impression Material, Flexicoid" (A. Reynolds), demonstrating the accuracy of a new impression material made in Great Britain which appeared to be superior to alginate or hydrocolloid; "A New Teaching Aid for Operative Dentistry" (E. Rosentiel), clear and colored resin showing an exact reproduction of human teeth to demonstrate the true relationship between the hard and soft tissues of the tooth.

It was also pleasing to see two representatives of the United States Air Force Dental Services, Maj. J. Jackson, showing planned partial dentures, and Capt. M. A. Lipski, demonstrating modification of the edgewise technic.

Commercial television will be an accomplished fact in Great Britain in the near future, writes W. Stewart Ross. An Independent Television Authority has been set up by the Government, and the British Dental Association has been invited to nominate a representative to serve on the advisory committee. This committee will be responsible for seeing that ethical principles are maintained in the television programs.

Gerald H. Leatherman,
D.M.D., F.D.S.R.C.S.

Association Affairs

PROGRAM PLANNING BEGUN FOR ANNUAL MEETING

An appeal has been made to secretaries of the dental societies, deans of the dental schools, heads of the federal dental services and other organizations in the dental field requesting material for possible presentation on the scientific program of the Association's 96th annual session in San Francisco October 17-20. In the appeal Charles S. Kurz, chairman of the Council on Scientific Session, called attention to the popularity of the projected clinics at the Miami meeting. He pointed out also that the Council is scheduling an extensive program of table clinics and "is particularly interested in study groups which might present a group clinic."

At the same time, Donald Washburn, director of the scientific exhibit, announced that letters have gone out inviting applications for exhibit space. Requests should be made early, Dr. Washburn stated.

All scientific sessions will be held in the Civic Auditorium, it has been announced. The Board of Trustees and the House of Delegates will meet in the Fairmont Hotel. Also at the Fairmont will be the luncheon for international guests. The state officers' conference is scheduled for the Mark Hopkins, the ladies' luncheon and fashion show at the Sheraton Palace. The banquet honoring President Daniel F. Lynch will be held at the Sheraton Palace also.

All housing for the annual session is handled through the Association Housing Bureau, open April 1. An application blank appears on page A-20 of THE JOURNAL.

Francis J. Herz is serving as chairman of the general committee on local arrangements; Robert O. Schraft as vice-chairman, and Lawrence R. Ludwigsen, as secretary-treasurer. Serving on the general committee as chairmen of the subcommittees are: Edward H. Windeler, committee on reception; Edward J. Lattig, committee on information services; Reuben L. Blake, committee on publicity; T. Galt Atwood, committee on entertainment and social events; Mrs. Robert O. Schraft, committee on women's entertainment, and G. Thomas Quigg, committee on clinics and motion pictures.

LAUNCH DRIVE TO HELP KOREAN DENTISTRY

A nationwide campaign to enlist all dentists in support of a program to rehabilitate dental education and dental health services in war-ravaged South Korea is being sponsored by the American-Korean Foundation and the American Dental Association. The campaign will be launched formally April 5 by President Eisenhower at a White House luncheon.

Guests at the luncheon will include top officers of the American Dental Association and the American-Korean Foundation as well as members of dental, medical and pharmaceutical advisory committees.

Representing the Association will be Daniel F. Lynch, president; Leslie M. FitzGerald, immediate past president; Oren A. Oliver and Obed H. Moen, chairman and secretary respectively of the Council on International Relations; John A. Moore of Tacoma, Washington;

In Arkansas government and civic groups cooperated in the observance of Children's Dental Health Week February 7-13. Governor Orville E. Faubus proclaims the event. Watching (l. to r.) are: Maurice J. Friedman, Arkansas State Dental Association; James F. Sawyer, Central District Dental Society president, and J. R. Luten, Jr., Arkansas unit, American Society of Dentistry for Children.

Leo J. Schoeny of New Orleans, and Maurice Williams of New York.

All members of the Association are being invited to participate actively in the campaign. Special dental memberships in the American-Korean Foundation are being made available at five dollars each. Constituent society presidents have been asked to serve as state chairmen for the drive. In last year's drive more than 50,000 pounds of dental supplies and equipment were collected to aid the Seoul National University Dental College.

ATTENTION FOCUSED ON CHILDREN'S DENTAL HEALTH

Children's dental health was in the national spotlight February 7-13 as communities across the country observed National Children's Dental Health Week. State departments of health, parent-teacher associations and other community organizations worked with state and local dental societies to bring the dental profession's health message to the public.

Daniel F. Lynch, president of the American Dental Association, issued a special message to all parents on the eve of the observance and said, "Ignorance about dental health is widespread. Not until sound preventive measures are translated effectively by parents into consistent and continuing use by our children, can they avoid the dental crippling of their elders."

State and local dental societies throughout the country arranged for special programs. In Oklahoma City, the dental society arranged a "smile" contest. In Arkansas the Arkansas State Dental Association enlisted the cooperation of the Joint Coordinating Committee for Promoting Health Education in the Public Schools, the Arkansas Congress of Parents and Teachers, the Arkansas Education Association and the state Division of Dental Hygiene.

In Kansas, posters were on display in all the drug stores of the state. Among the groups cooperating with the dental society were the Kansas Tuberculosis and Health Association and the Kansas State Board of Health. Some 250,000 copies of "Dennis the Menace" dental health leaflet were distributed by the state dental society. On the local level, the Oral Hygiene Committee of Greater New York, representing the first, second and tenth District Dental Societies, ar-

Dental societies of the nation celebrated Children's Dental Health Week February 7-13. **Right:** Mayor Morrison of Daytona Beach, Fla., announces the event. Dental officials with him are (l. to r.): T. W. Schroeder, Volusia County society president; Charles Fain, Jr., and Robert Thoburn, state society president.

Above: Gov. Dwindell of New Hampshire (right) congratulates winners of a poster contest. Francis I. Livingston, state director of dental services and an official of the state society, looks on.

Above: William S. Hutton, medical officer of Brantford, Ontario (left), and Frederick S. McKay of Colorado Springs, Colo., pioneers in the study of fluorides, toast America's children with fluoridated water at the Detroit observance.

Left: New York children visit Borough of Manhattan president Jack (seated), with Arnold Joseph and Anthony J. Poggi (l. to r.), of the First and Second District Dental Societies.

ranged for three large-scale expositions where free roentgenograms and instruction in tooth care were provided.

In Detroit the observance was arranged to commemorate the end of the first ten year water fluoridation project at Grand Rapids, Mich., and to honor two pioneers in the study of fluorides. The men honored were Frederick S. McKay of Colorado Springs, Colo., and William S. Hutton, medical officer of the city of Brantford, Ontario.

In addition, the Detroit District Dental Society appealed to Mayor Cobo for immediate action on a fluoridation program for Detroit. Two years previously, the City Council had resolved to begin the program but nothing was done. Following the Detroit meeting and the resolution of the Detroit Society, the City Council took its fluoridation resolution from the table and began discussion once again.

Nondental groups cooperating in the dental health week observance included the Metropolitan Life Insurance Company, which presented announcements on 75 radio stations in the U.S. and Canada, and the Borden Milk Company, which presented dental health messages on radio stations of 21 cities. Television shows carrying dental health messages included the daily Howdy Doody show on the NBC network. In addition, International News Service prepared a special feature article on the observance for all its newspaper clients.

FLUORIDE DENTIFRICES APPEAR ON MARKET

A new round of claims of "therapeutic powers" for dentifrices appeared in the offing last week as Proctor and Gamble announced the beginning of over-the-counter sales of a tooth paste containing stannous fluoride. The test sales are limited to three cities. The dentifrice, called Crest, was advertised as containing Fluoristan, which Proctor and Gamble described as "fluoride in its most effective form." In an article on the new dentifrice, the trade publication *Advertising Age* noted that Colgate's and Block Drug Co. also were preparing to market fluoride tooth pastes.

"We know of no present adequate demonstration that any dentifrice presently on the market is significantly useful in preventing tooth decay except as it assists the toothbrush in the prompt removal of sugar residues from the mouth," J. Roy Doty, secretary of the Council on Dental Therapeutics, reported in response to inquiries from trade sources. Dr. Doty pointed out also that the Council "knows of no substitute for fluoridation of public water supplies."

ASSOCIATION COMMENTS ON SOKOLSKY NEWS ARTICLE

The American Dental Association late in February replied to an attack on fluoridation made by George Sokolsky in a recent syndicated news column. Mr. Sokolsky had claimed that fluoride as used in water fluoridation is a poison.

In commenting on the writer's statement, the Association letter called attention to the "voluminous scientific literature" which contradicts Mr. Sokolsky's statement. "Every major health group concerned with the effects of fluoridation has evaluated the evidence on fluoridation and has endorsed, approved and recommended the measure," the letter stated. "Millions of Americans have been drinking naturally fluoridated water for many years and . . . there is no evidence whatever of toxicity."

"The Association believes," the letter continued, "that it is something short of the highest type of public service when unsubstantiated charges against a public health measure are presented without, at least, some indication that an overwhelming mass of evidence from recognized sources exists to refute these charges."

ANOTHER RECORD HIGH FOR NATIONAL BOARD EXAMINATION

Another record has been set in the number of persons taking the National Board examinations. Over 3,600 dental school students, civilian dentists, and dentists in the armed services took the tests March 28 and 29. This number exceeded that of March of last year by 300. Last year's figure also was a record high.

The Council of the National Board of Dental Examiners announced in March that the state of West Virginia had accepted the certificates and grades of the Board as partial fulfillment of licensing requirements. With the addition of West Virginia, there are 29 states now recognizing the National Board.

RELIEF FUND QUOTA EXCEEDED FOR THIRD STRAIGHT YEAR

The Relief Fund drive exceeded its quota for the third consecutive year when on February 28 contributions reached $101,040. By March 11 the total received was $103,023, just $3,000 away from an all-time high. Contributions were running ahead of those of a year ago by nearly $2,000.

Thirty-seven constituent societies and the U. S. Public Health Service had exceeded their quotas by the March 11 date. The smaller societies had contributed 107.5 per cent of quota; the larger ones, 101.4. Students contributed $633.

As of March 11 contributions were as follows:

Quota over $925

	Quota	Contributions to March 11	Pct.
California	$ 3,820.00	$ 4,235.00	110.9
So. California	4,580.00	8,533.50	186.3
Colorado	960.00	1,044.50	108.8
Connecticut	1,940.00	1,921.50	99.0
Florida	1,380.00	1,530.00	110.9
Georgia	1,020.00	1,499.10	147.0
Illinois	7,240.00	7,533.81	104.1
Indiana	2,340.00	2,418.00	103.3
Iowa	1,780.00	2,080.00	116.9
Kansas	960.00	907.65	94.5
Kentucky	1,130.00	1,353.30	119.8
Louisiana	1,020.00	1,055.50	103.5
Maryland	1,060.00	1,168.00	110.2
Massachusetts	3,690.00	1,847.50	50.1
Michigan	4,100.00	4,343.15	105.9
Minnesota	2,840.00	2,950.05	103.9
Missouri	2,450.00	2,515.50	102.7
Nebraska	1,060.00	1,170.00	110.4
New Jersey	4,020.00	4,302.50	107.0
New York	15,200.00	11,061.50	72.8
N. Carolina	1,240.00	1,339.00	108.0
Ohio	4,920.00	4,723.75	96.0
Oregon	1,230.00	1,369.00	111.3
Pennsylvania	6,810.00	5,341.25	78.4
Tennessee	1,310.00	3,703.00	282.7
Texas	3,190.00	2,666.50	83.6
Virginia	1,150.00	1,203.50	104.7
Washington	1,800.00	2,333.00	129.6
Wisconsin	2,930.00	2,212.50	75.5
Total	$87,170.00	$88,361.56	101.4

Quota of $925 or less

	Quota	Contributions to March 11	Pct.
Air Force	$ 600.00	$ 406.25	67.7
Alabama	800.00	1,558.50	194.8
Alaska	60.00	168.00	280.0
Arizona	300.00	104.00	34.7
Arkansas	560.00	647.50	115.6
Army	580.00	542.50	93.5
Delaware	150.00	165.00	110.0
Dist. of Col.	830.00	917.50	110.5
Hawaii	350.00	632.00	180.6
Idaho	260.00	316.50	121.7
Maine	460.00	356.00	77.4
Mississippi	530.00	486.00	91.7
Montana	370.00	545.00	147.3
Navy	920.00	539.50	58.6
Nevada	100.00	151.00	151.0
N. Hampshire	300.00	267.00	89.0
New Mexico	240.00	257.50	107.3
North Dakota	330.00	539.55	163.5
Oklahoma	920.00	981.00	106.6
P. Canal Zone	10.00	15.00	150.0
P. Health Serv.	210.00	280.00	133.3
Puerto Rico	190.00	298.50	157.1
Rhode Island	560.00	768.50	137.2
So. Carolina	450.00	334.50	74.3
South Dakota	350.00	514.00	146.9
Utah	470.00	618.50	131.6
Vermont	200.00	147.00	73.5
Vet. Admin.	810.00	342.00	42.2
West Virginia	760.00	740.75	97.5
Wyoming	160.00	148.50	92.8
Total	$12,830.00	$13,787.55	107.5

ISSUE 1954 INDEX TO DENTAL LITERATURE

The *1954 Index to Dental Literature*, published by the Bureau of Library and Indexing Service, will be available early in March, reports Donald A. Washburn, Bureau director. The 260 page volume contains the fourth quarter compilation as well as the material published in the three preceding quarterly *Indexes*. Nearly 6,000 items, including articles, obituaries, book reviews and editorials, from 158 publications have been indexed by author and subject.

Included are articles from all the English language dental journals, as well as material in English appearing in journals from such countries as Lebanon, Norway, Finland and Sweden. The *Index* may be purchased for $10 from the Order Department at the Central Office.

NEW FILMS LISTED IN LIBRARY PUBLICATION

A supplement to the publication *Audio-Visual Materials in Dentistry*, published by the Film Library of the Bureau of Library and Indexing Service, is now available, announces Helaine Levin, film librarian. The supplement lists films, filmstrips and slides recently obtained by the Film Library.

STATE SOCIETIES QUERIED ON NEW TRUSTEE DISTRICTS

A questionnaire has been sent to all constituent societies to determine their opinions on possible reorganization of trustee districts and reduction in the size of the House of Delegates, it was announced recently by Harold W. Oppice, chairman of the Special Committee on Reorganization of Trustee Districts. Individual members also are invited to send their opinions to Dr. Oppice, at 1002 Wilson Ave., Chicago.

Members of the committee are Clyde R. Flood of Seattle; C. M. Taylor of Houston, Texas; John B. Wilson of San Marino, Calif.; W. N. Hodgkin of Warrenton, Va.; John P. Looby of Philadelphia, and Henry M. Willits of Dubuque, Iowa.

COUNCIL REVIEWS HEALTH LEGISLATION, GROUP PLANS

Proposed federal health legislation, union-management dental programs, the financing of dental care and other aspects of dental public health were reviewed by the Council on Dental Health at its Chicago meeting February 20-22. David W. Brock, Council chairman, presided.

The Council sent to the Board of Trustees a number of recommendations for Association policy on the President's proposed health program. It suggested limitations on the dental care to be provided members of the proposed National Security Training Corps. It urged appropriation of adequate funds for dental research.

In the field of union-management dental care programs, the Council stressed the fact that societies not yet faced with requests from unions for help in developing dental care plans should still be prepared to give proper advice. A guide outlining suggested steps for such societies was adopted. In addition, lists of labor newsletters and other publications useful as sources of information are being drawn up, Dr. Brock announced. Copies of the lists and the guide will be available shortly, he said. The Council is considering also a conference on the planning and negotiating of union-management dental care plans.

In other actions, the Council decided to revise for House of Delegates' approval the 1953 statement "Principles for Determining the Acceptability of Dental Prepayment Plans" and agreed to review a survey made by Group Health Dental

Insurance, Inc., of New York, on the incidence of dental disease in an adult urban group. In addition, the Council will survey vocational rehabilitation programs of the states.

Donald H. Miller of Elmira, N. Y., was elected vice-chairman. The Council will meet again in June.

BUREAU PUBLISHES BOOKLET GUIDE TO DENTAL HEALTH

A completely rewritten version of *Your Guide to Dental Health* has been prepared by the Bureau of Dental Health Education. Designed to explain some of the basic facts concerning teeth, this illustrated booklet discusses the structure of teeth and the supporting tissues, presents a few simple dental health rules, describes the most prevalent dental diseases with their causes and treatment and stresses the need for preventive dentistry.

Single copies are available free of charge from the Bureau. Quantity orders may be obtained from the Order Department at the Central Office at the following prices: 25 copies, $2.25; 50 copies, $3.80; 100 copies, $6.45.

ASSOCIATION RESOLUTION IN CONGRESSIONAL RECORD

A resolution adopted by the Association House of Delegates calling for increased U.S. support of the World Health Organization has been placed in the *Congressional Record* by Senator Wiley (R., Wis.). The Association and the Fédération Dentaire Internationale have long sought expansion of WHO activities to include the establishment of a permanent program on dental health. Senator Wiley, in placing the Association's resolution in the *Congressional Record,* noted that President Eisenhower has urged an increased contribution to the World Health Organization.

TRUTH DOLLARS ASKED FOR RADIO FREE EUROPE

The dental profession has been urged to support the 1955 Crusade for Freedom on behalf of Radio Free Europe. Daniel F. Lynch, Association president, in February called on all dentists to sign "Freedom Scrolls" and contribute "Truth Dollars" for the broadcasting network during the drive, which takes place during February, March and April. Scrolls and other material for the campaign may be obtained from the American Heritage Foundation, 345 E. 46 St., New York 17.

Legislation

INCREASE RESEARCH, CUT TRAINEE CARE, CONGRESS TOLD

In written statements sent late in February to two Congressional committees, Association officials urged increased support for dental research and proposed limitations on the amount of dental care to be made available for trainees under the proposed National Security Training Corps.

J. Claude Earnest, vice-chairman of the Council on Legislation, pointed out the need for a sufficient number of dentists to care for the civilian population and said that in view of this need, dental care for youths in the six month training program should be limited to emergency dental treatment. Under the proposed revision of the reserve system, 200,000 men would be trained annually.

Posttraining dental care, Dr. Earnest said, should be "limited essentially to the treatment of oral injuries and diseases directly caused by training duty." Dr. Earnest's statement also urged deferment for dental students from liability for recall to active duty outlined in the training program.

The Association called for increased

support for dental research in a statement signed by Floyd W. Pillars, a member of the Council on Legislation. Dr. Pillars asked that funds for dental research projects be increased from $421,000 to one million dollars and that grants for dental research fellowships be raised from $100,000 to $250,000. He urged appropriation of the $1,900,000 already authorized by Congress for a building to house the National Institute of Dental Research.

In recommending the increased appropriations, Dr. Pillars said, "Dental research support from the federal government . . . does not represent by any measure an adequate appreciation of the nation's dental health problem."

ASSOCIATION URGES LIMIT ON VA DENTAL CARE

The Veterans Administration's outpatient dental care program was the subject of Association testimony before two Congressional committees last month. Rudolph H. Friedrich, chairman of the Council on Dental Health, and Bernard J. Conway, secretary of the Council on Legislation, appeared before a subcommittee of the House Veterans Affairs Committee to testify against H.R. 4481, introduced by the subcommittee chairman, Congressman George S. Long of Louisiana. The bill would remove present restrictions on the VA's outpatient dental care program. The Association representatives appeared also before a subcommittee of the House Committee on Appropriations in support of proposed appropriations for the VA.

Dr. Friedrich urged the Congressmen to turn down the Long proposal and to pass instead H.R. 1793, introduced by Congressman Peter Frelinghuysen of New Jersey. The Frelinghuysen bill would write into law existing limitations on the VA's outpatient dental program; the Frelinghuysen bill is in accord with Association policy.

PENTAGON PROPOSES MEDICAL SCHOLARSHIP PLAN

The Defense Department early in March sent to Capitol Hill a bill to set up a military scholarship program in the medical and dental schools. Purpose of H.R. 4645 is to increase the number of physicians and dentists in the regular Army, Navy and Air Force.

Under the proposed plan, students would be provided scholarships and in return would be required to serve a specified number of years on active duty. An advisory body to select scholars is provided for in the bill.

HOOVER REPORT URGES CUT IN GOVERNMENT HEALTH SERVICES

The Hoover Commission late in February released its special study of federal health and medical services and recommended drastic cuts and changes in such services. The medical services of the Veterans Administration bore the brunt of the suggested economy drive, but medical programs of the Armed Forces, the U. S. Public Health Service and other federal arms also will be curtailed if the Commission's recommendations are adopted by the Congress.

The Commission's report differed considerably from the report of its medical service task force which had been assigned the job of assessing the government's activities in the health field. Many task force recommendations were either ignored or overruled.

Of major interest to dentistry was the task force recommendation that the physician-dentist draft be discontinued. The task force said that the special draft was "unfair in principle" and "abused in administration." The Commission overruled its task force, however, and recommended instead that the Secretary of Defense, with the assistance of a proposed Federal Advisory Council of Health, "develop recommendations for

revision of the Selective Service Act to effect maximum utilization of medical personnel."

A second proposal of the task force relating to the special draft, that the ratio of dentists to troops be reduced from the present 1.9 dentists per 1,000 troops to 1.7, also was overruled by the Commission. The task force in making its recommendation criticized the Armed Forces for "making incomplete use" of the professional skills of health personnel in some areas and for "even diverting them to other uses. . . . This points to the need for some method of control outside the Department of Defense," the report said. "We believe that the most effective means of effecting such control is the establishment of ratio ceilings."

The Commission said, "The determination of actual ratios of physicians and dentists to active duty personnel should be left to the Department of Defense."

A procedure advocated repeatedly by the American Dental Association as a substitute for the special draft was recommended by the task force. This proposal called for special provisions in the regular draft to place in separate categories dental and medical students and new graduates and to make separate calls to the individual states for draft vulnerable men in these categories.

In other areas of military dental affairs, the task force recommended that comprehensive dental care be provided primarily for career personnel in the Armed Forces. Dental care for military dependents should be limited to emergencies, the report said. The Hoover Commission proposed that a system of voluntary health insurance be developed, with the government as a contributor, to cover dependents. The task force also recommended a wider use of auxiliary personnel in the dental corps. Both the task force and the Commission agreed on the importance of more effective in-service training for professional health personnel.

The dentist member of the medical task force, which included 15 leaders in the health field, was Otto W. Brandhorst of St. Louis, former Association president. There was also a subcommittee on dentistry, headed by Dr. Brandhorst, and including Rudolph H. Friedrich, then chairman of the Council on Federal Dental Services, James P. Hollers, member of the advisory council to the Assistant Secretary of Defense on Health and Medical Affairs, and Leo J. Schoeny, member of the Health Resources Advisory Committee of the Office of Defense Mobilization. Staff members of the subcommittee were Bernard J. Conway, then secretary of the Council on Federal Dental Services, and Francis J. Garvey, then secretary of the Council on Legislation.

Dental Societies

E. E. EWBANK, PROMINENT INDIANA DENTIST, DIES

E. E. Ewbank of Kingman, Ind., for many years a top official of the Indiana State Dental Association, died March 18 shortly before his 81st birthday. He would have been 81 years old March 23.

Prominent in the affairs of the state dental association, Dr. Ewbank served as its secretary-manager for 16 years. In addition, he was a delegate to the American Dental Association House of Delegates and served on such state society committees as insurance, press and relief. He was the first president of the Ben-Hur component society and represented it on the state association's board of trustees. Dr. Ewbank was a life member of the American Dental Association.

At the state society's annual session in May 1954, Dr. Ewbank's contributions to organized dentistry were recognized when the association elected him its first honorary president.

Olin Kirkland (left), a former vice-president of the American Dental Association, celebrated his 79th birthday recently. Montgomery, Ala., dentists marked the event by presenting him with three volumes of congratulatory messages from Dr. Kirkland's many friends. John Carter makes the presentation.

OLIN KIRKLAND HONORED BY ALABAMA DENTISTS

Olin Kirkland, a former vice-president and trustee of the American Dental Association, celebrated his 79th birthday recently. Montgomery, Ala., dentists marked the event by presenting him with three volumes of congratulatory messages from Dr. Kirkland's many friends in the United States and Canada.

Dr. Kirkland continues in practice and teaches courses at the University of Alabama, Emory University and Tufts College Dental School. He has been a member of the House of Delegates on and off during the past 40 years. He is also a former president of the Alabama Dental Association.

SOCIETY NAMES COMMITTEE TO WORK WITH LABOR GROUPS

In order to provide professional and scientific leadership in the development of dental care programs which may be proposed by organized groups, the Pennsylvania State Dental Society has named a committee on relationships with labor unions. The members are: Homer D. Butts, Jr., of Pittsburgh, William Perry Manning of Philadelphia, C. Boyd Ellsworth of Johnstown, Louis E. Yerkes of Allentown and Charles S. Gaige of Lancaster.

Ex-officio and staff members are Charles H. Patton, third district trustee; Jay G. Eshleman, member of the American Dental Association's Council on Dental Health; Thomas P. Fox, Ray Cobaugh and William Madden, Jr., president, executive-secretary and attorney, respectively, of the state dental association.

PERCY PHILLIPS RETIRES AS SOCIETY SECRETARY

Percy T. Phillips, secretary of the First District Dental Society of New York, has retired from office because of personal reasons. Dr. Phillips held the post for ten years. Serving organized dentistry in

Kenneth C. Pruden's teeth are examined by his father, William H. Pruden, 93, oldest living past president of the Essex County (N.J.) Dental Society during the society's midwinter meeting in February. Looking on (l. to r.) are: William A. Giblin, president of the New Jersey State Dental Society, Daniel F. Lynch, president of the American Dental Association, and William E. Caffrey, president of the Essex County Dental Society.

Some 100 dentists from all parts of Michigan attended the district officers' conference March 12 and 13 in Lansing, Mich. Among speakers and officials were, seated (l. to r.): Harold Hillenbrand, secretary, American Dental Association; Douglas M. Teel, president, Michigan State Dental Association; J. R. Short, conference chairman; Raymond W. Welmoth, president-elect, Michigan State Dental Association. Standing (l. to r.): Fred Wertheimer, secretary, Michigan State Dental Association; J. L. Champagne of Detroit; P. H. Jaserich, ninth district trustee; R. A. Hart, vice-president, Michigan State Dental Association; Henry Green and Neil D. Gotschall of Detroit.

many capacities, Dr. Phillips has been president of the First District Dental Society, chairman of the Greater New York Dental Meeting, Speaker of the House of Delegates of the American Dental Association, and is presently the Association's Trustee for the second district.

He has been active in the Bronx County Dental Society, in the New York Academy of Dentistry and in the Dental Society of the State of New York. Dr. Phillips' unexpired term will be completed by Isidore Teich.

FIRST ISSUE OUT OF REDESIGNED STATE JOURNAL

The newly redesigned journal of the Indiana State Dental Association made its appearance in February. The journal has a 6x9 inch page size. It contains scientific articles, editorial comments, news from the component societies and from the dental assistants. Harold C. Dimmich of Fort Wayne, Ind., continues as editor. Mr. Broderick H. Johnson, the society's executive secretary, serves as managing editor and business manager.

Dental Education

HAROLD NOYES TO HEAD DENTAL SCHOOL ASSOCIATION

Harold J. Noyes of the University of Oregon was elected president of the American Association of Dental Schools at its meeting March 20-23 in Chicago.

Other officers elected are: Lee Roy Main, dean of St. Louis University, president-elect; Roy Ellis, dean of the University of Toronto dental school, vice-president; Marion W. McCrea of the University of Maryland dental school, secretary-treasurer, and Robert W. McNulty, dean of the School of Dentistry, University of Southern California, executive committee member.

Willard C. Fleming, dean of the Col-

lege of Dentistry, University of California, was nominated to the Council on Dental Education for the term ending 1958. Nominated to the Council of the National Board of Dental Examiners for the term ending 1958 was Joseph C. Muhler of the University of Indiana.

SCHOOL AND SOCIETY SPONSOR DENTAL HEALTH CONFERENCE

"The Dental Health of Children—Whose Responsibility?" and "Insurance and Group Plans for Dental Care" will be discussed at the Eighth Annual Conference on Dental Health sponsored by the School of Dentistry of the University of Pittsburgh and the Odontological Society of Western Pennsylvania. The meeting will be held May 4 in Pittsburgh.

Among those participating in panel discussions will be David W. Brock, chairman of the American Dental Association Council on Dental Health; Perry Sandell, director of the Association's Division of Dental Health Education; Linwood Grace, director of the dental division, Pennsylvania Department of Health; Mollie D. Foster, associate professor of pedodontics at the Pittsburgh dental school, and E. R. Aston, dental consultant to the Bureau of Industrial Hygiene, Pennsylvania Department of Health.

SCHOOLS OFFER COURSES, INTERNSHIPS, RESIDENCIES

College of Physicians and Surgeons • A graduate program in oral surgery which meets the requirements of the American Board of Oral Surgery is offered by the College of Physicians and Surgeons in San Francisco. The three year program includes an internship, position as assistant resident and resident. Salary, room and board are included. Also offered by the school is a rotating internship in dentistry. Designed for the student who wishes to expand his undergraduate training or to prepare for the state licensing examination, the internship provides work at the hospital and courses at the College at the postgraduate level.

Columbia • Principles of occlusion will be presented May 11-13 by Lewis Fox and associates at Columbia University School of Dental and Oral Surgery in New York. The fundamentals of occlusion will be discussed in relation to the physiology and pathology of the periodontal tissues. Application must be made no later than April 30.

Emory • Emory University School of Dentistry in Atlanta, Ga., has scheduled a one week postgraduate course in periodontology May 23-27. Half the course time will be devoted to clinical practice; the rest to lectures and seminars.

Kansas City • Applications for graduate study in oral surgery are now being accepted by the University of Kansas City School of Dentistry in Kansas City, Mo. The three year course is offered in conjunction with Kansas City General Hospital Number One and is designed to meet the requirements of the American Board of Oral Surgery. The program begins July 1. Information may be obtained from the department of surgery at the School.

The School announces also that a rotating internship, offered in conjunction with the Veterans Administration Hospital of Kansas City, is now available. The one year internship begins July 1. Information on the internship may be obtained from James P. Darnell, chief of the dental section, Veterans Administration Hospital, 4801 Linwood Blvd., Kansas City, Mo.

New York • New York University College of Dentistry in New York will con-

duct a one week workshop June 20-24 in the development of skills for good patient relations. Entitled "Workshop in Practice Management," the course will offer individual training in conversational technics useful in dealing with patients and will cover also a review of fee arrangements, budget plans, credit and collection procedures.

In addition, a 36 hour course in endodontics is offered June 6-17. The class is limited to ten.

Several courses in periodontics and oral medicine will be given beginning in June, September and October. Both half-time and full-time courses are available. Information may be obtained from the secretary of the postgraduate division at the College in New York.

Northwestern • The graduate department of orthodontics of Northwestern University Dental School will present an advanced course in cephalometric roentgenography June 14-16 at the school in Chicago. A basic course in the subject is a prerequisite for this program.

Pennsylvania • A new two year graduate course in periodontology sponsored jointly by the University of Pennsylvania Graduate School of Medicine in Philadelphia and Beth Israel Hospital in Boston was announced recently. Six students will be accepted for the program. The course consists of one academic year at the Graduate School and one year at the Hospital with time devoted to clinical practice and to research. Applications should be sent to the Office of the Dean, Graduate School of Medicine, University of Pennsylvania, Philadelphia 4.

The School of Dentistry has announced a course in hydrocolloid indirect technic for inlays and bridges to be given by Morris J. Thompson of Beverly Hills, Calif., in May. Participants from outside the Philadelphia area will attend sessions May 7 and 8. Those from Philadelphia will attend May 7 and 9.

Washington (Seattle) • Walter C. McBride of Detroit and the staff of the department of pedodontics of the University of Washington School of Dentistry in Seattle will teach a course in dentistry for children May 2 and 3. Intended to highlight the more important phases of pedodontics, the course will cover diagnosis, operative procedures, pulp therapy and the management of the child patient.

Research

PAUL E. BOYLE ELECTED I.A.D.R. PRESIDENT

Paul E. Boyle of the University of Pennsylvania was elected president of the International Association for Dental Research at its March 18-20 meeting in Chicago. Selected for the post of president-elect was Joseph F. Volker, dean of the School of Dentistry, University of Alabama.

Other officers are: Reidar Sognnaes of the Harvard School of Dental Medicine, vice-president; Edward H. Hatton, professor emeritus of Northwestern University, secretary-treasurer, and Dan Y. Burrill of the University of Louisville, assistant secretary-treasurer. Paul C. Kitchin was re-elected trustee.

The Novice Award of $100, given for the best paper among those submitted by researchers who have never before presented a paper before a national scientific group, went to D. E. Waite and C. E. Staley of the University of Iowa. The prize winning study was entitled "Pulpal Changes Resulting from Freezing Storage Technics."

Winner of the Souder Award was Richard L. Coleman, director of research for the J. M. Ney Company in Hartford, Conn. The Souder Award, presented for the first time, was established by the dental materials group of the I.A.D.R. and is given for outstanding contributions to the science of dental materials.

National Defense

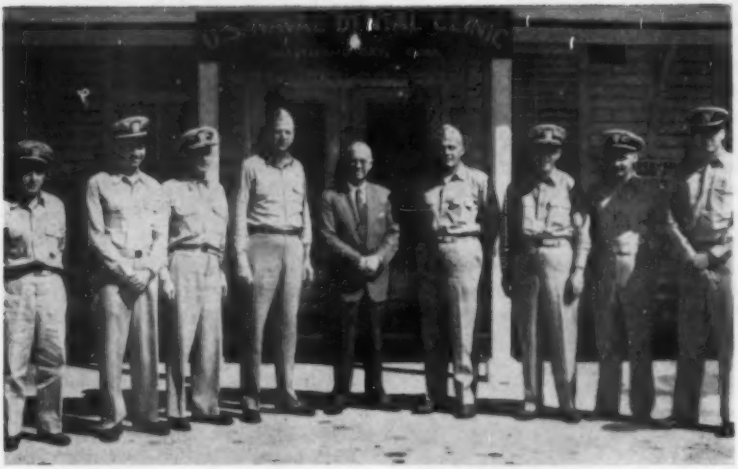
NAVY DENTAL RESERVE GETS FIRST WOMAN COMMANDER

Sara G. Krout, recently appointed commander, is the first woman to have achieved this rank in the history of the Navy Dental Corps Reserve. A graduate of the College of Dentistry of the University of Illinois in 1928, Commander Krout has been in private practice since that time except for her wartime service. She has been on the dental clinic staff of the Women and Children's Hospital of Chicago since 1933.

Commander Krout was commissioned in the Navy Dental Corps in February 1944 and was ordered to active duty that year. She was the first woman to have been commissioned in the Dental Corps. Since the war, Commander Krout has been an active member of the Evanston Dental Unit of the U.S. Naval Reserve headed by Capt. Paul Wells.

Cmdr. Krout

Rear Admiral Ralph W. Malone became chief of the Navy Dental Corps March 3. Among the guests at the installation ceremonies were (standing l. to r.): Rear Admiral I. L. V. Norman (MC) USN; Rear Admiral W. P. Dana (MC) USN; Capt. B. H. Faubion (DC) USN; C. Willard Camalier, assistant secretary, American Dental Association; Rear Admiral D. W. Ryan (DC) USN; Rear Admiral J. R. Fulton (MC) USN; Maj. Gen. O. P. Snyder (DC) USA; Brig. Gen. M. E. Kennebeck (DC) USAF; Brig. Gen. L. H. Renfrow, USA; K. H. Wood, president, District of Columbia Dental Society, and E. H. Cushing, M.D., Deputy Assistant Secretary of Defense (Health and Medicine). Seated (l. to r.): Rear Admiral B. E. Bradley (MC) USN; Frank B. Berry, M.D., Assistant Secretary of Defense (Health and Medicine); Rear Admiral R. W. Malone (DC) USN, and Rear Admiral B. W. Hogan (MC) USN.



Above: James R. Cameron, College of Dentistry, University of Pennsylvania, lectured to dental officers at the U. S. Naval Dental Clinic, Guantanamo Bay, Cuba, January 12. Shown (l. to r.) are: Chief Warrant Officer T. K. Dote, Lieut. L. C. Pugliese, Commander G. S. De Shazo, Capt. W. D. Stagner, Dr. Cameron, Cmdr. J. B. Stoll, Cmdr. T. J. Ownley, Lieut. (jg) J. J. Lyons, and Lieut. (jg) L. W. Doss, Jr.

Below: Thomas Fox, dental member of the Health and Medical Advisory Council to the Department of Defense, recently visited the U. S. Naval Dental Clinic in Norfolk, Va. Shown (l. to r.) are: Capt. John Paul, clinic commanding officer; Capt. W. W. Lippold, executive officer, and Dr. Fox.

Above: Admiral Daniel W. Ryan (left) was made an honorary member of the Panamanian Dental Association January 19. Dr. Brin makes the presentation.

TRAINING IN WARFARE DEFENSE OFFERED DENTISTS

Two weeks of training in chemical, biological and radiological warfare defense will begin May 15 in Washington, D. C., for physicians, dentists and other professional health personnel who will be called to duty in the event of national emergency. Class members will be officers of the Commissioned Reserve of the U. S. Public Health Service. The course is part of the Reserve expansion program announced recently by the USPHS.

Public Health

COURTS RULE AGAIN FOR HEALTH MEASURE

Fluoridation is neither "compulsory mass medication" nor an "unreasonable invasion of the right of the individual" the Wisconsin Supreme Court ruled in March. The court upheld the right of Milwaukee to fluoridate its water supply. Meanwhile, the U. S. Supreme Court for the third time rejected a suit against the health measure and upheld the right of Tulsa, Okla., to initiate the procedure.

CONDEMN PROPOSAL FOR UNREGULATED FLUORIDATION

A plan to distribute concentrated solutions of fluoride to families in Freehold, N. J., for individual use in their drinking water has been strongly condemned by the state health department. Daniel Bergsma, M.D., state commissioner of health, in a letter to the city's mayor, pointed out that this method "has been rejected by qualified medical, dental and public health organizations as being ineffective in providing a proper dosage to minimize the occurrence of dental caries; and the possibility of unregulated intake in homes represents a potential hazard."

The letter concluded, "This department, realizing the value of fluoridation, has drawn up regulations for a proper, safe and effective method of introducing sodium fluoride into a community water supply. Administered in the recommended fashion, fluoridation has been proven to reduce dental caries up to 65 per cent with absolute safety."

ANCHORAGE, ALASKA, RETAINS CARIES CONTROL MEASURE

An educational program at Anchorage, Alaska, has resulted in retention of that city's fluoridation program, which has been in operation since November 30, 1953. Prior to a public meeting called by the city council, the Cook Inlet Branch of the American Association for the Advancement of Science held a public seminar at which five papers on fluoridation were presented. At the city council's public meeting dentists, physicians and public health officials answered those who questioned the advisability of the caries-preventive measure. The city council voted to continue the program.

NEW FLUORIDATION PROGRAMS BEGIN IN SIX STATES

New fluoridation programs were reported in six states during the month of February. More than 69,000 persons are served by these projects. Largest of the new programs was established in Greeley, Colo., where the health measure will serve some 32,000 persons.

Fluoridation received attention from a national health organization recently when during a March 22-25 meeting, the National Health Council conducted a panel discussion on the health measure. John W. Knutson, assistant surgeon general and dental chief of the U. S. Public Health Service, was chairman of the panel.

ANTISCIENTIFIC ATTITUDE OF FLUORIDATION FOES TOLD

An analysis of antifluoridation sentiment is reported by a social psychologist and a physician in an article entitled "A Study of the Anti-Scientific Attitude" published in the February issue of *Scientific American*. The authors are Bernard and Judith Mausner. The couple conducted a survey of Northampton, Mass., prior to an election to decide whether the community's fluoridation program should be continued. (The measure was defeated by a vote of two to one.)

They found that persons of higher education and incomes were more likely to favor fluoridation than those of lower social status. In addition, among persons approving fluoridation, almost 95 per cent accepted scientific organizations as reliable sources of information. Among those opposing the health measure, persons with little education tended to reject scientific authority while two-thirds of those with better than high school education professed to accept the authority of scientists. The deciding factor in opposition to fluoridation, the authors conclude, may be "the set of attitudes toward scientists developed during schooling."

International

INTERNATIONAL DENTAL MEETINGS

Brit. Soc. for the Study of Orthodontics	May 6-7	Sheffield, Yorks. UK.	Inquiries to H. Richards	35 Harley St., London W.1
Annual Meeting of Canadian Dental Association	May 15-18	Toronto, Ontario	D. Gullett	234 St. George St., Toronto, Ont., Can.
Seminario Anual del Grupo de Estudios Dentales U.S.C. de Mexico	May 15-19	Tehuacan, Puebla, Mexico	R. S. de Lascurain	Insurgentes 257-10, Mexico, D.F.
Europ. Org. for Research on Fluor. & Den. Caries Control	May 17-19	Geneva, Switzerland	Prof. A. J. Held	Institut de Médecine Dentaire, Geneva, Switzerland
French Orthodontic Society	May 19-22	Albi, Tarn, France	Merle Béral	2 avenue Gambetta, Albi, Tarn, France
Congrès Suisse d'Odontologie	May 20-22	Bürgenstock, Switzerland	Secretary	SSO, 37 Spitalgasse, Berne, Switzerland
Annual Meeting of Danish Dental Association	May 20-21	Kolding, Jutland	F. Orth	87 Vester Voldgade, Copenhagen, Denmark
Scandinavian Odontological Society	May 26-27	Göteborg, Sweden	Osten Kling	Göteborg, Sweden
Annual Meeting of British Dental Association	July 4-8	Glasgow, Scotland, U.K.	Secretary B.D.A.	13 Hill St., Berkeley Sq., London W.1
American Dental Society of Europe	July 11-14	Amsterdam, Netherlands	J. Molony	110 Harley St., London W.1

German Association Maxillofacial Surgery	July 27-30	Hamburg, Germany	Fritz Schön	(13b) Bad Reichenhall, Bayern, Ludwigstrasse 30, Germany
43rd Annual Meeting Fédération Dentaire Internationale	August 14-20	Copenhagen, Denmark	Sec. Gen. F.D.I. or W. Riis-Klausen	35 Devonshire Pl., London W.1 1 Alhambravej, Copenhagen, Denmark
3rd Scientihc Cong. Int. Ass. Dent. Stud.	Sept.	Malmö, Sweden	D. Evans	The Dental Hospital, 132 Gt. Charles St., Birmingham 3, G.B.
Austrian Dental Meeting	Sept. 1-4	Linz on the Danube	Prof. Dr. Hofer Medical Assn. of Upper Austria	Linz on the Danube, Dinghoferstrasse 4, Austria
ARPA Internationale 10th Congress	Sept. 5-10	Venice, Italy	Dr. Toldo	Ospedale Civile, Venezia, Italy
1st Congress Féd. Dentaire Yugo-Slave	Sept. 19-22	Ljubljana, Yugoslavia	Krusic Valter	22 Levstikova, Ljubljana, Yugoslavia
9th World Medical Assembly	Sept. 20-26	Vienna, Austria	L. Bauer	345 E. 46 St., New York 17
30th Cong. Associazione Italiana di Stomatologia	Sept. 12-17	Naples, Italy	Prof. G. Giardino	Clinica Odontoiatrica Univ. of Naples, Via S. Andrea delle Dame 6, Napoli, Italy
2nd Panhellenic Dental Congress & Special F.D.I. Meeting	Sept. 25-30	Athens, Greece	B. Stefanopoulos-Vrettos or Sec. Gen. F.D.I.	71 Skoufa Street, Athens, Greece 35 Devonshire Pl., London W.1
European Orthodontic Society	Oct. 2-7	Rome, Italy	Norman Gray	16 College Rd., Eastbourne, Sussex, England
14th Congrès Français de Stomatologie	Oct. 3-9	Paris, France	Robert Vrasse	2 rue de Miromesnil, Paris 8
1st Asian Dental Congress	Oct. 13-16	Tokyo, Japan	Secretary Japan Dental Association	3-1 Chome Ogawamachi, Kanda, Chiyodaku, Tokyo
96th Annual Session American Dental Association	Oct. 17-20	San Francisco, Calif., U.S.A.	H. Hillenbrand	222 E. Superior St., Chicago 11, Ill.
3rd Int. Dental Cong. Asociacion Dental Mexicana	Nov.	Mexico City, Mexico	R. M. Ruff	Insurgentes 257, Mexico 7, D.F.
Asociacion Odontologica Argentina	Nov. 10-12	Mendoza, Argentina	Esteban I. Biolcati	Junin 959, Buenos Aires, Argentina
29th Journées Dentaires de Paris	Nov. 22-26	Paris, France	R. Dupont	29 Blvd. Malesherbes, Paris

14th Australian Dental Congress	March 5-9, 1956	Melbourne, Vict. Australia	Secretary	147 Collins St., Melbourne, Vict., Australia
44th Annual Meeting Fédération Dentaire Internationale	May June, 1956	Zurich, Switzerland	H. Freihofer	15 Todistrasse, Zurich, Switzerland
Annual Meeting of Canadian Dental Association	June 3-6, 1956	Banff, Alberta, Canada	D. Gullett	234 St. George St., Toronto, Ont., Can.
Annual Meeting British Dental Association	June 25-29, 1956	Brighton Sussex, U.K.	Parker Buchanan	13 Hill St., Berkeley Sq., London W.1
13th German Dental Meeting	August, 1956	Munich, Bavaria	F. Witt	Universitätsstrasse 73, Koln- Lindenthal, Germany
97th Annual Session of American Dental Association	October 1-4, 1956	Atlantic City, N. J.	H. Hillenbrand	222 E. Superior St., Chicago 11, Ill.
12th Int. Dental Congress	Sept. 7-14, 1957	Rome, Italy	G. Corradi	8 Via Serpieri, Rome
American Dental Association Centennial Celebration	1959	New York	H. Hillenbrand	222 E. Superior St., Chicago 11, Ill.

WORLD HEALTH DAY THEME—CLEAN WATER MEANS HEALTH

"Clean Water Means Better Health" has been chosen as the theme of World Health Day set for April 7 by the World Health Organization. The theme was picked, according to the WHO, because clean water "is essential for health and for the economic life and growth of a community." Observance of World Health Day is expected to increase popular interest in health needs and to stimulate participation in the task of improving health.

HISTORY OF DENTISTRY TO BE PUBLISHED IN FRENCH

A book by J. Leonard Andre-Bonnet entitled *Histoire Générale de la Chirugie-Dentaire* (A General History of Dentistry) will be published in April. The book will cover the dentistry of the early Egyptians and Chinese, that of the Middle Ages and the evolution of modern methods and technics, including the origin of porcelain teeth and the discovery of anesthesia. Copies of the book, which sells for $16.50, may be obtained from A. Levilliers, Gometz Le-Chatel, Seine-et-Oise, Paris, France.

A special rate is offered Association members who order the book prior to its public issuance.

JAPANESE SOCIETY CALLS FIRST ASIAN CONGRESS

The Japanese Dental Association will sponsor the First Asian Dental Congress in Tokyo October 13-16. Invitations have been sent to dental associations in the countries concerned.

The conference is being called "for the furtherance of dental science among the countries of Asia," the Japanese society states. In its invitation to the meeting, the group suggests that an inter-

national preparations committee be established, composed of members from the participating dental associations.

American dentists planning on attending the October congress are asked to contact Harold Hillenbrand, secretary of the American Dental Association, 222 E. Superior St., Chicago 11.

LIST CLINICIANS FOR MEXICAN DENTAL MEETING

Harry Sicher, M.D., of Chicago, Donald E. Smith and Robert Willey of Los Angeles are among the clinicians participating in the Eighth Annual Seminar of the University of Southern California Dental Study Club of Mexico, announces Roman S. de Lascurain, Seminar secretary. The meeting will take place May 22-26 at the Hotel Penafiel, Tehuacan, Puebla, Mexico.

Other speakers include Marsh Robinson of Los Angeles, Luis Farill of Mexico City, Miguel Rosani of Monterrey and Roberto Sanchez of Mexico City. Information on the meeting may be obtained from Dr. de Lascurain, Seminario Anual del Grupo de Estudios Dentales U.S.C. de Mexico, Insurgentes 257-10, Mexico, D.F.

General

ERLING JOHANSEN REPLACES JOHN HEIN AT ROCHESTER

Erling Johansen, D.M.D., senior fellow in dental research at the University of Rochester School of Medicine and Dentistry, has been appointed chairman of the department of dentistry and dental research. He replaces John W. Hein, who has been appointed dental director of the Colgate-Palmolive Company. Dr. Johansen's appointment became effective March 1.

Dr. Johansen received his D.M.D. degree from the Eksamen Artium, Orkdal Landsgymnas, in Norway in 1943. He was a student Fellow in oral pathology at the Tufts College Dental School during 1948 and 1949. In 1949 he was a member of the Royal Norwegian Army Dental Corps. Dr. Johansen came to the University of Rochester in 1950.

Also • A life member of the American Dental Association, Charles D. Carter of Kingston, N. Y., has retired after 50 years of practice. Dr. Carter counts among his accomplishments the formation of the Ulster-Greene Dental Study Club in Kingston. . . . Capt. Eric B. Hoag was appointed Thirteenth Naval District Dental Officer recently, according to the Washington State Dental Journal. . . . New officers of the Middle Atlantic Society of Oral Surgeons are C. Richard Miller, president; Joseph F. Conlon, president-elect; Frank N. Carroll, vice-president, and Lloyd E. Church, secretary-treasurer. . . . Stanley Suit of Cleveland and Alfred Jason of Chicago have been added to the board of directors of the Academy of General Dentistry. . . . *The Dispatcher,* newspaper of the International Longshoremen and Warehousemen's Union, reports that as of March 1 some 3,550 children had been signed up in the welfare fund dental care program. . . . The 72nd annual banquet of the Loyola University (Chicago) alumni association will be held April 20 in Chicago. . . . Temple University's dental alumni will meet April 27, Drake Hotel, Philadelphia. . . . The Association of Women Dentists of New York meets May 11 at the Statler Hotel. . . . New supervisor for the St. Louis dental program is Ozias M. Paquin, Jr., retired dental director of the USPHS. The appointment was effective March 14.

Book Reviews

BACTERIOLOGY FOR STUDENTS OF DENTAL SURGERY

By R. B. Lucas, M.D., and Ivor R. H. Kramer, L.D.S. 262 pages with 57 illustrations, 1 in color. Index. Price $3.15. London, J. and A. Churchill, Ltd., 1954.

The authors intend this book to take the place of textbooks written "primarily for medical students." Furthermore, they desired to "direct" the subject of bacteriology particularly to dental students. These goals are worthy and have been considered by various teachers in dental schools in the United States. However, in my opinion, the book by itself does not fulfill the aims of its authors.

The table of contents shows that out of 253 pages only 17 are devoted to the microorganisms or diseases of the oral cavity. Dental caries is discussed in eight pages and periodontal disease in three. The remainder of the book consists of extremely brief chapters describing all of the major groups of microorganisms.

In the chapter on streptococci no mention is made of bacteremia after operations in the oral cavity or elsewhere in the body. In other words, it appears to the reader that the book is little more than an abbreviated edition of textbooks written for medical students.

The print is readable, on paper of fair grade. Typographical errors are rather frequent. The illustrations are very poor; for example, the colored picture of a smear of sputum has been retouched to emphasize the tubercle bacilli; pictures are out of focus or at too low magnification to show what the authors want the student to see. The legends are too brief. This book is not recommended either for dental students or practitioners in the United States.

Ned B. Williams

THE PHYSIOLOGY OF MAN

By L. L. Langley, Ph.D., and E. Cheraskin, M.D. 609 pages with 180 illustrations. Index. Price $5.50. New York, McGraw-Hill Book Co., Inc., 1954.

"Physiology is the study of what makes us tick" according to these authors, who courageously attempt to simplify the presentation of the physiology of man. Their method consists of leaving out controversial material and presenting physiological concepts in a dogmatic manner. The authors have stated in their preface that the book was presented not primarily to stimulate thinking but to give fundamental concepts without which thinking is impossible. They do not include any bibliographical material, and in view of their neglect of controversial issues, the absence of a bibliography is a glaring omission in a book intended for student use. The lack of bibliography may lead the student to believe that all physiological phenomena are easily and simply explained, which is not true.

In an attempt to make "learning fun," many eye-catching cartoons supplement the text. These illustrations, in many cases, fail to make clear their point.

The book is well organized, and the subject matter integrated in a logical fashion. It is divided into five parts—the nervous system, the circulatory system, the respiratory system, the alimentary system and the endocrine system. As a textbook, this presentation fails to be one that can be used as source information, but as a book for presenting "the facts," it may have value for survey physiology courses or general reading.

A. C. Lane

DIE ZAHN-, MUND- UND KIEFERHEILKUNDE: EIN HANDBUCH FUER DIE ZAHNAERZTLICHE PRAXIS (THERAPY OF THE TEETH, MOUTH AND JAWS: A MANUAL FOR DENTAL PRACTICE)

Edited by Karl Häupl, Prof. Dr.; William Meyer, Prof. Dr.; Karl Schuchardt, Prof. Dr. For sale only in complete set of volumes. München-Berlin, Urban & Schwarzenberg (1953, 1954). Issue 8. 151 pages with 94 illustrations.

The first part of issue 8 deals with the science of statics and articulation in full denture construction. Dr. Fischer describes the selection and placement of teeth and the scientific management of the important factors in prosthetic occlusion. Fourteen illustrations make this account interesting. Dr. Haupl discusses in three chapters the theory and practice of crown, removable bridge and partial denture construction.

The theoretical part of the book is detailed and will help the reader to understand the problems of mouth restorations. Forty clear illustrations accompany this section.

Dr. Hruska outlines in one chapter all the steps necessary to produce satisfactory fixed bridges. He describes an implant bridge constructed according to a modified form of Brill's method. Dr. Hruska declares that such a bridge has given gratifying results. Instead of the porcelain roots used by Brill, the author employs perforated plastic roots which are wedged into preformed holes in the bone structure. These roots protrude into the oral cavity to support an esthetic and functional restoration and are held in place by bone and by deposition of granulation tissue, which invades the pierced roots.

It is a risky enterprise indeed. The reader and patient should be aware of the hazards involved in the making of such a construction. In spite of this, the report is interesting. But it would be more interesting if Dr. Hruska would publish his results after a five year period of observation. Dr. Hruska's contribution contains 40 excellent illustrations.

Eugene Schorr

THE MEANING OF SOCIAL MEDICINE

By Iago Galdston, M.D. 137 pages. Index. Price $2.75. Cambridge, Mass., Harvard University Press, 1954.

The author does an excellent job of defining what he means by "social medicine" in his first chapter. After the first chapter's well-documented discussion, the author goes on to a challenging presentation of the "failure" of modern medicine, giving the exact way in which the "failure" has occurred. This "failure," incidentally, is not only that of the present but is related to various events in the past. The author discusses particularly some of the vicissitudes faced by Pasteur, who was not a physician.

In the third and fourth chapters, the activities of medicine in the areas of etiology and epidemiology in the struggle against diseases are reviewed, the author pointing out what he considers are essential divergences of these activities from pure social medicine. Next, Dr. Galdston points out that, in converting mortality into morbidity in the case of numerous diseases that once were potent death-dealers, medicine has actually gotten itself into more trouble, because of the lag in acceptance of social medicine concepts with which to solve pressing health problems.

How the integration of social medicine education into the framework of general medical education can best be accomplished is considered in a somewhat briefer chapter, but its brevity is compensated for by the excellence of the evaluation and the practical suggestions on procedure. Every dentist, as well as physician, will find this volume of much interest.

W. W. Bolton

AMERICAN TEXTBOOK OF OPERATIVE DENTISTRY

Edited by Arthur B. Gabel, D.D.S., M.A. Ninth edition. 626 pages with 422 illustrations. Index. Price $10. Philadelphia, Lea & Febiger, 1954.

The fact that this textbook is in its ninth edition is ample evidence of its popularity. The text is divided into nine chapters and follows closely the plan of the previous edition. Some chapters have been revised slightly. An orderly arrangement of the material provides a logical basis for an understanding of the clinical procedures which are described.

In the previous edition, Boyle and Thoma were coauthors of the chapter on examination and diagnosis. In this latest edition, Dr. Thoma's name has been omitted. In this same chapter, a more extensive description of periodontal disease has been added. D. Walter Cohen, associate in oral medicine and oral pathology, Dental School, University of Pennsylvania, is responsible for this addition. The chapter on dentistry for children that appeared previously is left out; the author states that this subject is dealt with more fully in textbooks written exclusively on the subject.

The book covers in a concise and understandable manner some fundamental phases of operative dentistry that are requisite to the intelligent practice of dentistry. The text fills a definite need of students and practitioners.

The book format is good. The style is direct. The illustrations throughout are clear. The bibliography following each chapter is extensive, and the index is adequate.

E. Alan Lieban

ANOMALIES DENTO-CRANIO-FACIALES

By Maurice Lepoivre. 127 pages with 85 illustrations. Index. Price 860 F. Paris, Masson and Co., 1954.

The problem of abnormalities and their hereditary nature has attracted attention for many years. The old concepts have been replaced by new theories founded on scientific research.

A new science called genetics has been born. Unfortunately, to date, satisfactory progress has not been made. Too many problems remain unsolved.

After many years of research, Dr. Lepoivre takes this opportunity to explain the etiology of malformation and deformation of the dento-cranio-facial system. He discusses the growth of facial bones and teeth and the development of occlusion. The book covers the period of organogenesis, fecundation up to the third month of the intra-uterine life, and the period of morphogenesis, from the third month of the intra-uterine life to adult age. Growth continues after birth, the only change being the environment.

Among the many etiologic factors mentioned, Dr. Lepoivre includes the effects of the roentgen ray and radium, virus infections, endocrine glands and the lack of vitamins such as vitamin B-2 in the formation of the cleft palate. He supports his explanation with case histories and experimental data.

The further study of organogenesis and morphogenesis in genetics may help solve many problems. This book is highly recommended to all orthodontists and dentists interested in maxillofacial development and deformation.

Hratch Abrahamian

MUSIC THERAPY

Edited by Edward Podolsky, M.D. 335 pages. Price $6. New York, Philosophical Library, 1953.

Persons interested in any kind of music therapy should find informative material in this book. Among the extensive list of contributors are physicians, psychologists, and occupational and music therapists. Seemingly, they are all persons well qualified in this field.

A chapter of particular interest to dentists is entitled "The use and therapeutic value of music in the hospital and operating room." This chapter was contributed by a group of physicians from the division of plastic surgery, Duke University School of Medicine. Specific information is given not only on the types of music used but how the music is produced. This chapter, like many of the others, contains a good bibliography.

Dentists who are using hypnosis in their practice might be interested in the statement that "under hypnosis music has been found to have a particularly beneficial effect." The use of music in the alleviation of anxiety states and emotional disturbances is discussed as well as the effects of music on respiration and heart rate.

The records used as musical sedatives and during various unpleasant experiences (such as shock treatment) are listed in several places in the book. These lists include the composer, the title of the composition, the name of the company which produced the record and the number of the record.

The book is not light reading, but it is worthwhile for those seriously interested in the therapeutic use of music in a wide range of conditions.

Josephine P. Hunt

SOCIAL SCIENCE IN MEDICINE

By Leo W. Simmons, Ph.D., and Harold G. Wolff, M.D. 254 pages. Index. Price $3.50. New York, Russell Sage Foundation, 1954.

In this book an appeal is made to the medical profession to aid in the integration of biological and sociological knowledge. The physician who relies on the biophysical sciences also deals daily with an abundance of psychosocial data.

The editors call attention to the serious liabilities of the present-day use of hospitals, the loss of the leisurely personal contact between staff and patient and the housing of large numbers of gravely ill persons, a condition which has produced special risks both physical and psychosocial. Assembly line methods increase the likelihood of oversights, making difficult the orientation of patient care around individual needs.

Although it has long been apparent that medicine and social science are equally concerned in their special way with human behavior, medicine has devoted itself mainly to those aspects of behavior which involve pain, physiological and organic responses—those phenomena, in short, which threaten the survival or comfort of the individual.

Social science, on the other hand, has been preoccupied with the study of man in his social environment—the way in which social relationships are organized and carried on, the interaction of persons with different status and roles and the relationship of all these to individual or social survival. To produce the most desirable cooperation between medicine and the social sciences certain prerequisites must be met, one of which is the alerting of personnel of both disciplines to the areas of common concern.

The Russell Sage Foundation has as its current program the improvement of utilization of social science research in professional practice. This book ably demonstrates how these disciplines have advanced to a point

where fruitful collaboration between medical scientists and social scientists is feasible and is in progress of development. The book should be read by public-spirited citizens who share responsibility for health and welfare programs.

R. M. Walls

DIE HALS, -NASEN, -OHRENHEILKUNDE FÜR STUDIERENDE DER ZAHNHEILKUNDE UND ZAHNÄRZTE

By Helmut Loebell, Prof. Dr. med. Fourth edition. 90 pages with 25 illustrations. Index. 7.50 DM. Leipzig, Germany, Johann Ambrosius Barth, 1954.

This book, designed for dental students and dentists, is a compendium of diseases of the throat, nose and ear. The clinical considerations and pathology of each organ are preceded by a description of its anatomy and physiology.

The book may be helpful in giving the student or practitioner a quick orientation in the subject. However, the special and extensive literature must be consulted for an adequate understanding of the pathological conditions which occur in the mouth or jaws and which reach the neighboring organs.

Eugene Schorr

HISTORY OF THE THEORIES OF AETHER AND ELECTRICITY: THE MODERN THEORIES 1900-1926

By Sir Edmund Whittaker, F.R.S. 319 pages. Index. Price $8.75. New York, Philosophical Library, Inc., 1954.

The dentist who wishes to keep abreast of the changing world of modern physics will find it helpful to follow the historical approach. For example, the title of this book refers to the ether. Although this word has been dropped for a time in modern physics, the author points out that it is still useful. The ether originally was thought to be a medium in which electromagnetic waves could be conducted from distant bodies, such as the stars, to the earth. Every test for the presence of this medium, however, has failed.

In the meantime, the interplanetary spaces have been conceived of as being mere emptiness, having no properties except that of propagating electromagnetic waves. In modern physical theory this vacuum has come to be regarded as the seat of the zero point oscillations of the electromagnetic field. The author feels that it is absurd to retain the name vacuum for an entity so rich in physical properties and, therefore, uses the historical word ether.

The first volume of this series, which dealt with the physics of the nineteenth century, was published in 1910. The present volume published in 1954 is the second of the series. A third volume, on the period since 1926, is yet to come.

The present volume starts with the epoch-making investigations of Becquerel and Roentgen. The very basis of modern physics was discovered through such events as the exposure of photographic emulsion placed near uranium ores. The enigma of these new rays forced a complete change in the theories of the science of physics.

William Ward Wainwright

DENTISTERIE OPERATOIRE

By P. Nespoulous and G. Carlier. Second edition. 649 pages with 430 illustrations. Index. Paris, Masson and Co., 1954.

This is the fourth volume of *La Pratique Stomatologique*. The series of *La Pratique Stomatologique*, nine volumes in number, contains the best books published on dentistry in France. This fourth volume is entirely revised and covers operative dentistry and endodontics. The first part is devoted to oral anatomy, physiology, dental materials, office installations and patient examination.

The second part covers such subjects as prophylaxis and pulp canal therapy. Interesting methods of treatment of pulp injuries and periapical lesions are described and this section probably will prove to be the most interesting for the American reader.

The third part is devoted to the preparation of cavities. Unfortunately, this chapter lacks definition, detail and clarity. Many illustrations, some of them taken from other publications, do not have adequate explanations in the text.

The various technics explained by the authors are largely outmoded. Lengthy discussions result in confusion for the student reader. In several instances, after describing many technics, the authors fail to state their technic preference. Modern instruments are hardly mentioned.

The chapter on the treatment of the dental pulp is worth careful consideration; especially good is the description of sterilization and obturation of the root canals. Ozone therapy, ionophoresis and other technics are described in full.

Hratch Abrahamian

Current Literature

DENTAL CARIES IN THE COTTON RAT XIV. FURTHER STUDIES OF CARIES PRODUCTION BY NATURAL DIETS WITH ESPECIAL REFERENCE TO THE ROLE OF MINERALS, FAT, AND THE STAGE OF REFINEMENT OF CEREALS

Marguerite A. Constant, H. William Sievert, Paul H. Phillips and C. A. Elvehjem. J. Nutrition 53:17 May 10, 1954.

Although increased tooth decay in laboratory animals occurs with increased sugar consumption, studies have shown that the level of refined sugar does not represent a reliable criterion for predicting the cariogenicity of the diet.

Experiments were conducted to study the effect of certain minerals, dietary fat, tooth maturity and processed cereals on incidence of dental caries in the teeth of weanling cotton rats. In one series of experiments, the milk in a cereal-milk-sucrose diet was replaced with casein and dextrin; with casein, dextrin and fat; or by casein and dextrin with sugar omitted. Decreasing the milk content resulted in increased caries in all instances, even when sucrose was omitted.

Next, the effect of loss of minerals when substitutions were made for dried whole milk was tested. The addition of 1 per cent or more of calcium carbonate or dibasic sodium phosphate noticeably reduced decay. The increase in the pH of the diet which occurred when the basic minerals were added suggests that the pH of the diet influences cariogenicity. Animals fed the cereal-dextrin-sucrose-fat-plus-$CaCO_3$ had the healthiest-appearing teeth.

To test the effect of tooth maturity, the cariogenic diet was fed when animals were 7 weeks old instead of 19 to 21 days. This delay resulted in a considerable decrease in tooth decay.

The reduction in tooth decay caused by the dietary mineral supplements indicates that certain dietary minerals influence the development of caries of erupted teeth of cotton rats. The loss of mineral when substitutions were made for dried whole milk was partly responsible for the greater cariogenicity of milk free diets.

When no soluble sugar was added, teeth of animals still showed considerable caries activity. Substitution of 7 per cent oily fat for the natural fat in whole milk gave a partial protection against tooth decay.

Tests were made to determine at which stage of processing of cereals increased cariogenicity occurred. Whole oats, groats before and after steaming and rolled oats were fed. It was observed that the increased cariogenicity of processed oats occurred at the dehulling step.

Dorothea F. Radusch

INCIDENCE OF CARIES DURING ORTHODONTIC TREATMENT

E. N. Bach. Am. J. Orthodont. 39:756 Oct. 1953.

The teeth of some 2,000 children who received orthodontic treatment were compared with the teeth of children who received little dental care.

A detailed record of pathological conditions was made before orthodontic treatment was started and again at the conclusion of treatment, a period of about 4.2 years. Children who received no orthodontic treatment had approximately three times more caries than those who received orthodontic treatment.

In the study of the children receiving orthodontic treatment, comparisons were made between children with different diet patterns. At the beginning of treatment, the patients who consumed an excessive amount of carbohydrates had approximately 1.5 per cent less decalcified regions and on an average .25 less filling than the patients who consumed a minimum amount of carbohydrates, a fact which is the opposite of what is generally believed.

At the conclusion of treatment, however, the consumer of the excessive amounts of carbohydrates had 1.3 per cent more decalcified regions and 0.6 more filling than the consumer of a minimum amount of carbohydrates.

The patient who consumed a minimum amount of fruits and vegetables had approximately 1 per cent more decalcified regions than the consumer of excessive amounts of carbohydrates before treatment and 2 per cent more at the conclusion of treatment.

The average number of fillings was the same at the start for consumers both of minimum and excessive amounts of fruits and vegetables. After three and a half years, there were four and a half times more fillings in the teeth of the patients consuming a minimum of fruits and vegetables than in the teeth of those consuming an excessive amount.

Deaths

Bradley, Elmer W., Hawthorne, N. J.; died November 30; aged 63.

Johnson, James K., Louisville, Ky.; School of Dentistry, St. Louis University, 1907; died November 25; aged 47.

Johnson, John A., Middletown, Del.; Philadelphia Dental College, 1897; died November 12; aged 84.

Johnston, McRae B., St. George, S. C.; Atlanta Dental College, 1905; died November 7; aged 68.

Jones, George H., Duluth, Minn.; Dental School, Marquette University, 1896; died October 25; aged 76.

Koelz, William J., Keyser, W. Va.; Baltimore College of Dental Surgery, University of Maryland, 1904; died August 2.

Kotzker, Morris A., Philadelphia; School of Dentistry, Temple University, 1916; died November 16; aged 68.

Kramer, Kalmun K., St. Louis; Dental School Tufts College, 1934; died October 18; aged 45.

Lafayette, Albert M., Syracuse, N. Y.; Philadelphia Dental College, 1898; died November 14; aged 82.

Lamb, Harold R., Greenfield, Mass.; Dental School, Tufts College, 1913; died November 6; aged 64.

Lee, Marcellas D., Dallas, Texas; School of Dentistry, University of Texas, 1952; died November 8; aged 34.

Litten, Arthur S., New York; Philadelphia Dental College, 1904; died November 20; aged 82.

Love, Robert D., South Bend, Ind.; Dental Department, Meharry Medical College, 1920; died November 4; aged 60.

Lundberg, John L., Detroit; College of Dental Surgery, University of Michigan, 1918; died November 4; aged 64.

MacDonald, Reginald A., Albany, N. Y.; College of Dental Surgery, University of Michigan, 1916; died October 3; aged 70.

Mair, Arthur B., Highland Park, Mich.; School of Dentistry, Royal College of Dental Surgeons, Toronto, 1922; died November 11; aged 54.

Marshall, Guy C., Herkimer, N. Y.; School of Dentistry, University of Pennsylvania, 1914; died November 12; aged 61.

Mayland, Walter C., Chicago; Dental School, Northwestern University, 1913; died December 25; aged 63.

Mendelsohn, Gabriel M., Lynn, Mass.; died November 12; aged 61.

Miller, James H., Ottumwa, Iowa; College of Dentistry, University of Iowa, 1929; died October 17; aged 50.

Mitchell, Harry H., Bonham, Texas; Louisville College of Dentistry of Centre College, 1902; died November 26; aged 83.

Neidig, Harry A., Kittanning, Pa.; School of Dentistry, University of Pittsburgh, 1932; died October 26; aged 47.

Panzica, Russell C., Buffalo; Faculty of Dentistry, University of Toronto, 1935; died November 8; aged 50.

Pedersen, Wilbur H., Decatur, Ga.; College of Dentistry, University of Iowa, 1935; died October 31; aged 47.

Peterson, Arthur C., Chicago; Chicago College of Dental Surgery, Loyola University, 1921; died December 9.

Pfouts, Royal E., Canton, Ohio; Dental School, Northwestern University, 1907; died November 19; aged 74.

Picha, George, Cicero, Ill.; College of Dentistry, University of Illinois, 1928; died November 22; aged 53.

Prendergast, Leonard F., Ashland, Ohio; College of Dentistry, Western Reserve University, 1925; died November 14; aged 57.

Price, John H., Brush, Colo.; School of Dentistry, University of Denver, 1923; died September 19; aged 57.

Pugh, William H., Kansas City, Mo.; Kansas City Dental College, 1905; died October 10; aged 78.

Rederich, Thomas J., Vancouver, Wash.; School of Dentistry, North Pacific College of Oregon, Portland, 1908; died October 7; aged 70.

Reese, Paul S., Los Angeles; College of Dentistry, University of Southern California, 1915; died September 29; aged 78.

Rehermann, John F., New York; New York College of Dentistry, 1913; died November 24; aged 68.

Reilly, Philip A., San Francisco; College of Dentistry, University of California, 1922; died December 8; aged 54.

Reiss, Henry H., Brooklyn; College of Dental and Oral Surgery, New York, 1914; died October 16; aged 63.

Rice, Albert, Northampton, Mass.; School of Dentistry, University of Pennsylvania, 1901; died November 11; aged 75.

Rink, Howard C., Hollywood, Fla.; School of Dentistry, University of Pittsburgh, 1914; died December 2; aged 67.

Rogers, Russell H., Moultrie, Ga.; Atlanta Dental College, 1903; died October 16; aged 80.

Rowell, James W., Leon, Iowa; Pennsylvania College of Dental Surgery, Philadelphia, 1888; died in 1950; aged 86.

Sampe, Arthur A., Racine, Wis.; Dental School, Marquette University, 1926; died August 19; aged 51.

Samuels, Max G., Los Angeles; College of Dentistry, University of Southern California, 1916; died April 13, 1954; aged 70.

Schaefer, Roy C., Redfield, S. Dak.; Dental School, Northwestern University, 1923; died June 14; aged 59.

Schectman, Maurice G., Chicago; College of Dentistry, University of Illinois, 1924; died December 28; aged 52.

Schwab, Harry F., Corpus Christi, Texas; Atlanta Dental College, 1915; died September 19; aged 59.

Schwartz, Edward, Buffalo; School of Dentistry, University of Buffalo, 1915; died October 7; aged 75.

Scott, George B., St. Louis; School of Dentistry, St. Louis University, 1917; died September 19; aged 73.

Scott, Leslie E., Belleville, Ill.; School of Dentistry, Washington University, St. Louis, 1905; died November 14; aged 83.

Seal, Julian L., Odon, Ind.; Indiana Dental College, 1897; died November 5; aged 84.

Shea, Matthew F., Arlington, Mass.; Dental School, Tufts College, 1919; died March 3, 1954; aged 65.

Shellenberger, Paul F., Albuquerque, N. Mex.; College of Dentistry, University of Nebraska, 1923; died November 19; aged 59.

Shoore, Jerome S., Chicago; Chicago College of Dental Surgery, Loyola University, 1919; died November 29; aged 62.

Smith, Edwin H., Drexel Hill, Pa.; School of Dentistry, University of Pennsylvania, 1913; died October 25; aged 64.

Smith, Harry R., San Fernando, Calif.; Ohio College of Dental Surgery, University of Cincinnati, 1907; died October 29; aged 70.

Smith, Thomas J., Smithville, Texas; Baltimore College of Dental Surgery, 1901; died September 16; aged 77.

Smith, William B., Canton, Miss.; School of Dentistry, Vanderbilt University, 1909; died September 10; aged 67.

Stark, Jacob W., New York; College of Dental and Oral Surgery, New York, 1922; died November 9; aged 55.

Stearne, William V., Philadelphia; Philadelphia Dental College, 1907; died October 26; aged 68.

Stevens, Earl E., Menomonie, Wis.; Dental School, Marquette University, 1917; died November 17; aged 60.

Stewart, George L., Rural Valley, Pa.; Pittsburgh Dental College, Western University of Pennsylvania, 1899; died August 15; aged 84.

Struhall, Rudolph L., Austin, Texas; Dental School, Northwestern University, 1924; died October 21; aged 54.

Struve, Alfred W., Milwaukee; Dental School, Marquette University, 1916; died November 20; aged 59.

Sullivan, James M., Fall River, Mass.; School of Dentistry, University of Pennsylvania, 1911; died November 2.

Teter, William C., Cleveland Heights, Ohio; College of Dentistry, Ohio Medical University, 1903; died November 20; aged 81.

Thompson, Austin C., Torrington, Conn.; School of Dentistry, Temple University, 1895; died November 9; aged 83.

Tonkinson, W. G., Wood River, Ill.; School of Dentistry, St. Louis University, 1915; died in August; aged 66.

Trondson, Alexander S., Black River Falls, Wis.; College of Dentistry, University of Minnesota, 1902; died June 28; aged 75.

Trotter, L. C., Tulsa, Okla.; Kansas City-Western Dental College, 1940; died November 13; aged 41.

Tucker, Willard E., Springfield, Mo.; Western Dental College, 1903; died November 2; aged 74.

Urling, Harry W., Pittsburgh; Baltimore College of Dental Surgery, 1887; died November 2; aged 86.

Vicary, Edward E., Oakland, Calif.; College of Physicians and Surgeons, San Francisco, 1906; died November 28.

Vincent, Henry C., Joplin, Mo.; Louisville College of Dentistry of Centre College, 1907; died September 15; aged 69.

Voss, Albert E., Los Angeles; Chicago College of Dental Surgery, Loyola University, 1904; died December 13; aged 72.

Wagner, Edwin R., St. Louis; School of Dentistry, St. Louis University, 1918; died October 7; aged 59.

Wanous, Edwin F., Minneapolis; College of Dentistry, University of Minnesota, 1902; died October 18; aged 81.

Watkins, Frank E., Harrisburg, Pa.; School of Dentistry, Temple University, 1901; died October 27; aged 89.

Way, George F., Columbus, Ohio; College of Dentistry, Ohio State University, 1920; died November 14; aged 58.

Weidner, James W., Peoria, Ill.; Chicago College of Dental Surgery, Loyola University, 1917; died December 1; aged 60.

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Announcements

MEETINGS OF THE AMERICAN DENTAL ASSOCIATION

Ninety-Sixth Annual Session	Oct. 17-20, 1955	San Francisco
Ninety-Seventh Annual Session	Oct. 1-4, 1956	Atlantic City, N. J.
Ninety-Eighth Annual Session		Miami, Fla.
Ninety-Ninth Annual Session		Dallas, Texas
One-Hundredth Annual Session		New York

MEETINGS OF CONSTITUENT SOCIETIES

State	Date	Place	Secretary	Address
Alabama	Apr. 4, 5	Birmingham	F. A. Finney, Jr.	1045 Forrest Ave., Gadsden
Alaska	June 26-30	Juneau	R. M. MacKenzie	207 Mendenhall Apts., Juneau
Arizona	Apr. 27-30	Grand Canyon	R. W. Christensen	17 E. Weldon Ave., Phoenix
Arkansas	Apr. 3-6	Little Rock	D. M. Hamm	Box 89, Clarksville
California	Apr. 16	San Francisco	L. R. Ludwigsen	450 Sutter St., San Francisco
S. California	May 9-11	Los Angeles	J. P. Bowers	124 W. Lime Ave., Monrovia
Colorado	Oct. 2-5	Colorado Springs	W. R. Humphrey	724 Republic Bldg., Denver
Connecticut	May 18-20	Hartford	E. S. Arnold	37 Linnard Rd., W. Hartford
Delaware			R. V. Reed, Jr.	Medical Arts Bldg., Wilmington
District of Columbia	June 14	Washington	Z. B. Lloyd	2007 R St., N.W., Washington
Florida	Apr. 24-27	Jacksonville	J. E. Edwards	152 Alhambra Circle, Coral Gables
Georgia	Oct. 2-5	Atlanta	J. W. Yarbrough	Bibb Bldg., Macon
Hawaii	June 15-18	Honolulu	J. H. Dawe	810 N. Vineyard St., Honolulu
Idaho	May 19-21	Couer d'Alene	F. O'Halloran	Box 703, Coeur d'Alene
Illinois	May 9-12	Peoria	P. W. Clopper	623 Jefferson Bldg., Peoria
Indiana	May 16-18	Indianapolis	D. C. Barnhill	400 Bankers Trust Bldg., Indianapolis
Iowa	May 1-4	Des Moines	H. I. Wilson	639 Insurance Exchange Bldg., Des Moines
Kansas	May 15-18	Kansas City, Mo.	F. A. Richmond	861 Brotherhood Bldg., Kansas City
Kentucky	Apr. 18-21	Louisville	A. B. Coxwell, Jr.	1976 Douglass Blvd., Louisville
Louisiana	Apr. 13-16	New Orleans	J. S. Bernhard	2515 Line Ave., Shreveport
Maine	June 23-25	Rockland	S. M. Gower	Box 27, Skowhegan
Maryland	May 2-4	Baltimore	E. L. Pessagno, Jr.	415 Medical Arts Bldg., Baltimore
Massachusetts	May 1-4	Boston	H. E. Tingley	12 Bay State Rd., Boston
Michigan	Apr. 18-20	Detroit	F. Wertheimer	Michigan Dept. of Health, Lansing
Minnesota	Apr. 23-25, 1956	St. Paul	C. V. E. Cassel	225 Hamm Bldg., St. Paul
Mississippi	Apr. 24-27	Jackson	B. A. Cohen	306 Plaza Bldg., Jackson
Missouri	May 15-18	Kansas City	E. D. Suggett	201 Merchants Bank Bldg., Jefferson City
Montana	May 5-7	Bozeman	E. G. Vedova	Roundup
Nebraska	May 9-12	Lincoln	F. A. Pierson	1112 Federal Securities Bldg., Lincoln
Nevada	June 10-12	Lake Tahoe	O. M. Seifert	506 Humboldt St., Reno
New Hampshire	June 12-14	Whitefield	F. E. Williams	814 Elm St., Manchester
New Jersey	Apr. 18-20	Atlantic City	J. G. Carr	407 Cooper St., Camden
New Mexico	May 22-25	Ruidoso	J. S. Eilar	Medical Arts Square, Albuquerque
New York	May 16-18	New York	C. A. Wilkie	1 Hanson Place, Brooklyn
North Carolina	May 15-18	Pinehurst	R. D. Coffey	Kibler Bldg., Morganton
North Dakota	May 1-4	Grand Forks	V. B. Keltgen	517 de Lendrecie Bldg., Fargo
Ohio	Nov. 13-16	Cleveland	E. G. Jones	185 E. State St., Columbus
Oklahoma	Apr. 17-20	Tulsa	S. A. Russman	809 Medical Arts Bldg., Oklahoma City
Oregon			T. D. Holder	308 Selling Bldg., Portland
Panama Canal Zone	Apr. 6	Albrook Field Air Force Base	A. L. Teitel	Box D, U.S. Naval Station, Rodman
Pennsylvania	May 16-18	Philadelphia	M. D. Zimmerman	217 State St., Harrisburg
Puerto Rico			M. A. Rosso	Box 9023, San Juan
Rhode Island	Jan. 17, 18, 1956	Providence	B. C. Friedman	2 Ayrault St., Newport
South Carolina	May 22-24	Charleston	J. R. Owings	7 Medical Court, Greenville

State	Date	Place	Secretary	Address
South Dakota	May 15-17	Aberdeen	L. N. Thelen	229 S. Prairie St., Sioux Falls
Tennessee	May 8-12	Nashville	A. M. Ballentine	Pulaski
Texas	May 1-3	San Antonio	W. Ogle	3607 Gaston Ave., Dallas
Utah	Apr. 21-23	Ogden	R. C. Dalgleish	124 State Capitol Bldg., Salt Lake City
Vermont	May 30-June 1	Manchester	W. J. Reardon	18 Madison St., Rutland
Virginia	Apr. 29-May 6	Havana, Cuba	W. T. McAfee	705 Colonial National Bank Bldg., Roanoke
Washington			W. B. Martin	Medical-Dental Bldg., Seattle
West Virginia	July 24-27	White Sulphur Springs	G. N. Casto, Jr.	710½ Lee St., Charleston
Wisconsin	Apr. 25-27	Milwaukee	A. E. Kopp	Wells Bldg., Milwaukee
Wyoming	June 16-18	Cheyenne	T. J. Drew	State Office Bldg., Cheyenne

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

State	Date	Place	Secretary	Address
Alabama	June 20-24* June 20, 21†	Birmingham	W. L. McCarty	200 Professional Center, Montgomery
Alaska			R. H. Williams	Box 2122, Juneau
Arizona	June 20-26*†‡		R. K. Trueblood	107 East A Ave., Glendale
Arkansas	June 20-24*†	Little Rock	H. O. Weatherly	205 Halter Bldg., Conway
California	June 20 July 25	Los Angeles San Francisco	T. E. Tilden	Medico-Dental Bldg., Sacramento
Colorado	June 20-24	Denver	J. M. Peabody	724 Republic Bldg., Denver
Connecticut	June 19-25*†	New York Bridgeport	C. G. Brooks	302 State St., New London
Delaware	June 27-29	Wilmington	P. K. Musselman	143 W. Main St., Newark
District of Columbia			W. T. Birthright	Suite 718, 1835 Eye St., N.W. Washington
Florida	July 11-21*†	Jacksonville	A. W. Kellner	P. O. Box 155, Hollywood
Georgia			P. M. McNeil	307 First National Bank Bldg., Rome
Hawaii	Sept. 1, 2, 4, 5*†‡		H. L. Houvener	427 Dillingham Bldg., Honolulu
Idaho			R. E. Blickenstaff	1023 Fourth St., S., Nampa
Illinois			W. A. McKee	303 Wood Bldg., Benton
Indiana	June 14-17*†	Indianapolis	C. A. Frech	Gary National Bank Bldg., Gary
Iowa	May 23-27‡		D. J. FitzGerald	615 Brick & Tile Bldg., Mason City
Kansas	June 6-9	Kansas City, Mo.	G. L. Teall	Box 71, Hiawatha
Kentucky	June 6-9	Louisville	R. M. Justice	1330 Central Ave., Ashland
Louisiana	June 5-10	New Orleans	R. C. Steib	833 Maison Blanche Bldg., New Orleans
Maine	June 20-22	Boston	R. A. Derbyshire	Box 387, Skowhegan
Maryland	June 6-8‡		H. Levin	3429 Park Heights Ave., Baltimore
Massachusetts	June 13-16*† June 15, 16†‡		G. J. Fink	Rm. 33, State House, Boston
Michigan	June 8-11	Ann Arbor	J. L. Champagne	3714 W. McNichols Rd., Detroit
Minnesota	June 13-17*†‡		M. G. Walls	615 Montcalm Place, St. Paul
Mississippi	June 21-23	Jackson	J. C. Boswell	508 Lamar Life Bldg., Jackson
Missouri	June 13-18	St. Louis Kansas City	R. R. Rhoades	414 Central Trust Bldg., Jefferson City
Montana	July 11-14*†	Helena	V. J. Quinn	301 Phoenix Bldg., Butte
Nebraska	June 13	Lincoln	H. E. Weber	1210 Federal Securities Bldg., Lincoln
Nevada	June 13	Reno	R. Whitehead	Suite 6, Masonic Temple, Reno
New Hampshire	June 17, 18 June 17†‡	Boston	S. G. Markos	8 Renaud Ave., Dover
New Jersey	May 25-26* June 1, 2* June 8, 9*† June 13, 14*	Washington, D.C. Philadelphia New York Trenton	W. A. Wilson	150 E. State St., Trenton
New Mexico	June 20	Santa Fe	J. J. Clarke, Sr.	Artesia
New York			D. W. Beier	23 S. Pearl St., Albany
North Carolina	June 27-July 1	Chapel Hill	F. O. Alford	1107 Liberty Life Bldg., Charlotte
North Dakota	June 20-24	Fargo	A. L. Pushor	Lisbon
Ohio	June 16-18 June 20-22	Columbus	H. B. Smith	322 E. State St., Columbus

State	Date	Place	Secretary	Address
Oklahoma	June 16-18‡		R. P. Keidel	403 Surety Bldg., Muskogee
Oregon	June 6-9*†	Portland	F. L. Utter	506 Pioneer Trust Bldg., Salem
Pennsylvania	June 20-25	Philadelphia	A. M. Stinson	Dept. of Public Instruction, Box 911, Harrisburg
	June 20-22	Pittsburgh		
Puerto Rico			J. Mercado C.	Box 3717, Santurce
Rhode Island			F. M. Hackett	267 Academy Ave., Providence
South Carolina	June 16-18	Columbia	T. C. Sparks	1315 Pickens St., Columbia
South Dakota	June 19-22*†‡		H. T. Aker	Canton
Tennessee	June 13-17‡		C. R. Aita	619 Bennie Dillon Bldg., Nashville
Texas	June 12-18*	Dallas	R. T. Weber	312 Capital National Bank Bldg., Austin
	June 16-18†			
Utah	June 27-July 2	Salt Lake City	D. L. Folsom	1101 First Security Bank Bldg., Salt Lake City
Vermont	June 27-29	Burlington	P. M. Fitch	Newport
Virginia	June 6-11*	Richmond	J. M. Hughes	715 Medical Arts Bldg., Richmond
	June 6, 7†			
Washington	June 20-23	Seattle	M. L. Mower	National Bank of Commerce Bldg., Olympia
West Virginia	June 20-22*†	West Liberty	C. A. Laughlin	613 Prunty Bldg., Clarksburg
Wisconsin	June 13-17*†	Milwaukee	S. F. Donovan	Tomah
Wyoming			W. A. Hocker	210 O & S Bldg., Casper

Most states require applications to be in 30 days prior to examination date.
*Dental examination. †Dental hygiene examination. ‡Write to secretary of dental examining board for information on locations of examinations. §Approximate dates—verify with state dental examining board.

MEETINGS OF OTHER ORGANIZATIONS

Name	Date	Place	Secy. or Chm.	Address
Academy of Denture Prosthetics	May 1-8	New York	I. L. Furnas Secy.	928 Silverado St., La Jolla, Calif.
American Academy of Dental Medicine	May 13-15	New York	W. M. Greenhut Secy.	124 E. 84th St., New York
American Association of Industrial Dentists	Apr. 26-28	Buffalo	E. R. Aston Secy.	South Office Bldg., Harrisburg, Pa.
American Dental Society of Europe	July 11-14	Amsterdam, Netherlands	J. Moloney Hon. Secy.	110 Harley St., London, England
British Dental Association	July 4-8	Glasgow, Scotland	H. P. Buchanan Secy.	13 Hill St., Berkeley Square, London, England
Chicago Dental Society	Feb. 5-8, 1956	Chicago	K. S. Richardson Exec. Secy.	30 N. Michigan Ave., Chicago
Council on Dental Education, Dental Aptitude Tests	Apr. 29, 30		S. Peterson Secy.	222 E. Superior St., Chicago
Federation Dentaire Internationale	Aug. 14-20	Copenhagen, Denmark	G. H. Leatherman Secy. Gen.	35 Devonshire Place, London, England
First Congress of Oral Surgery of Cuba	Apr. 25, 26	Havana, Cuba	P. Garcia Secy.	Edificio Retiro Odontologico, Calle L No. 353, Vedado, Havana, Cuba
National Board of Dental Examiners	Dec. 5, 6		G. J. Casey Secy.	222 E. Superior St., Chicago
National Dental Association	Aug. 1-5	Chicago	J. A. Jackson Secy.	P. O. Box 197, Charlottesville, Va.
Northeastern Dental Society	June 5-8	Swampscott, Mass.	M. J. Frasca Secy.	153 Cabot St., Beverly, Mass.
Second Panhellenic Congress	Sept. 25-30	Athens, Greece	B. Stefanopoulos-Vrettos	71 Skoufa St., Athens, Greece
Seminario Anual del Grupo de Estudios Dentales U. S. C. de Mexico	May 15-19	Tehuacan, Puebla, Mex.	R. S. deLascurain Secy.	Insurgentes 257-10, Mexico, D.F.
Sixth Annual Berkshire Conference	June 19-23	Lenox, Mass.	I. Glickman Dir.	Tufts College Dental School, 136 Harrison Ave., Boston
Southeastern Society of Oral Surgeons	Apr. 22, 23	Havana, Cuba	J. E. Skaggs Secy.	509 Francis Bldg., Louisville, Ky.
Southern Society of Orthodontists	Sept. 25-28	Charlotte, N. C.	M. D. Edwards Secy.	132 Adams Ave., Montgomery, Ala.

created in natures likeness

In the never ending search for perfection, scientists have produced an effect in Luxene 44 which Oral Pathologists say simulates the appearance of natural gums with unusual fidelity. Actual color samples can be had from your Luxene Laboratory. The illustrations which follow will give you an idea how closely nature has been copied.

Luxene 44

Luxene 44 denture material was developed by Bakelite Corporation in collaboration with Carbide and Carbon Chemicals Corporation and Luxene, Inc.

Luxene 44 is not an acrylic resin. It is a vinyl co-polymer mixture plasticized with methyl methacrylate monomer and it possesses a combination of essential properties that have raised the standard of denture material values near the goal of perfection. It has been "built" by the world's foremost resin chemists specifically for dentures and it has no other commercial value.

However, it is one thing to produce a material which contains the essential properties of an ideal denture material but it is quite another thing to see that dentures made of this material are processed accurately and properly so that the valuable properties so painstakingly "built" into the product are not thrown away by careless or incompetent technicians.

To safeguard against this possibility, a precision technic has been developed which is known as the "Pressure Cast" process, and details of this process are covered in the following pages. Selected laboratories, which are competent and reliable, are equipped and trained to use the "Pressure Cast" process and they are capable of producing restorations in Luxene 44 to a standard of perfection, the highest anywhere known.

When Luxene-vinyl teeth are selected for use with Luxene 44 denture material, an even more serviceable and practical denture results because Luxene teeth do not crack or craze. The teeth are exceedingly tough and very rarely break, even if the denture is dropped on a tile floor. Luxene teeth also have superior wear resistance, extensive clinical tests over a period of several years has established this fact. The illustration used here is known as the All Luxene C-Tone denture. The C-Tone effect is created by laminating thin sheets of Luxene 44 with proper concentration of blue and red fibres. Oral pathologists say this effect simulates nature.

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VIRTUALLY ELIMINATES THE

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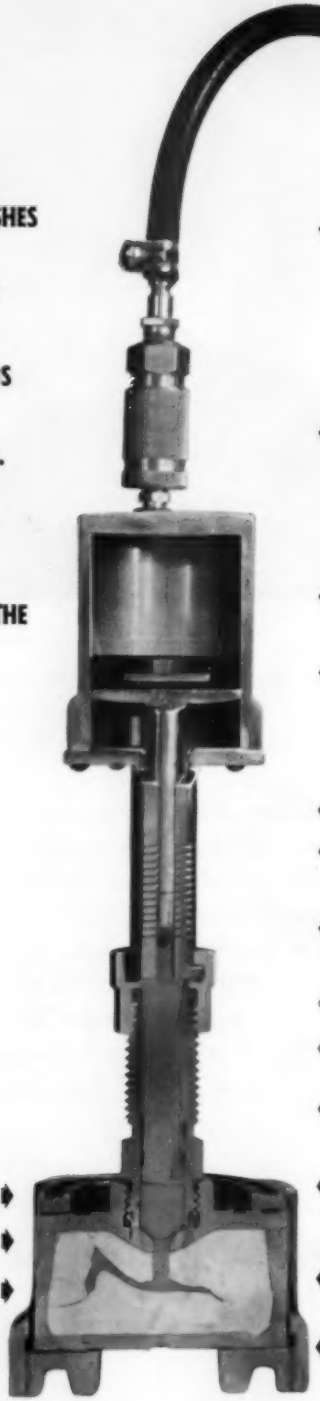

Hose to compressed air supply.

Air gun coupler permits an easy connection to air supply.

Air gun cylinder.

Air gun cup.

Air gun piston.

Air gun guide indicates amount inject

Hole in piston enables operator to rem the piston by slipping metal rod thro the hole and pulling it up. This is ne sary for recharging.

Air gun adapter.

Piston.

Nozzle threaded to screw into air adapter.

Lid and bottom surface perfectly flat so as to close uniformly.

Sprue button.

Side of cage.

In the center of the flask is a cross-sect of the moulded denture having no

Flask splits here. Notice how perfectly closed — metal to metal contact.

Bottom ring of the "cage" which, wh tightened in cage closer, closes the fl perfectly.

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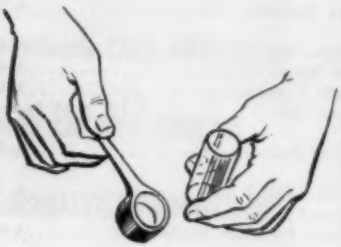

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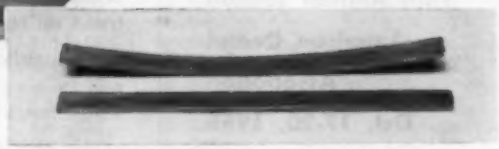

This shows why castings frequently warp. The upper bar was descaled by sandblasting; the other by Liquid Honing.

Warped castings are costly. It takes time to refit them. Some are never completely satisfactory; others must be made over. Warpage often occurs when a sand blast machine is used to remove from a casting the scale and roughness caused by investment.

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96th Annual Session
American Dental Association
Oct. 17-20, 1955
San Francisco

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Be sure to indicate your arrival time in San Francisco. Reservations will be held only until 6 p.m. of the day you indicate when you will arrive in San Francisco unless special arrangements are made with the hotel.

Names of all persons who intend to occupy the accommodations must be listed on the application.

List four choices of hotels. Confirmation will be sent to the applicant indicating which hotel has accepted the reservation.

Write the A.D.A. Housing Bureau in San Francisco if you wish to cancel the reservation.

A.D.A. HOUSING BUREAU • 61 GROVE STREET, SAN FRANCISCO 2

(Please print or type) A.D.A.

Applicant:

Name _____

_____
(Street address) (City) (Zone) (State)

Arrival in San Francisco _____ a.m. p.m. Leaving _____

Accommodations:

Hotel _____ (First choice) Hotel _____ (Third choice)

Hotel _____ (Second choice) Hotel _____ (Fourth choice)

☐ Single occupancy, rate to range from $_____ to $_____ per day.
☐ Double occupancy, double bed, rate to range from $_____ to $_____ per day. } 2 names must be listed below
☐ Double occupancy, twin beds, rate to range from $_____ to $_____ per day. }
☐ Suite of _____ rooms, including parlor, rate to range from $_____ to $_____ per day.

Occupants: (use an extra page for listing additional names if necessary)
Room will be occupied by:

_____
(Name) (Address) (City) (State)

_____
(Name) (Address) (City) (State)

HOTELS IN SAN FRANCISCO

KEY NO.	HOTEL	SINGLE	DOUBLE
1	Alexander Hamilton	$6.50–10.50	$ 9.00–13.50
2	Bellevue		8.00–11.00
3	Beverly Plaza	6.00– 7.00	8.50– 9.00
4	Biltmore	5.00– 6.00	5.00– 8.00
6	Californian		8.00–10.00
7	Canterbury		6.00–10.00
8	Carlton		5.50– 6.00
9	Cartwright		6.00– 7.00
10	Cecil	4.00– 6.00	5.00– 8.00
11	Chancellor	5.50	7.50– 8.50
12	Clift	8.00–14.00	10.00–20.00
13	Commodore	4.00– 7.00	6.00–10.00
15	Drake Wiltshire	7.00– 8.00	7.50–10.00
16	El Cortez	5.00– 7.00	6.00–10.00
17	Embassy	4.00– 5.00	4.00– 7.00
18	Fairmont	10.50–16.00	13.50–19.00
19	Fielding	4.00– 7.00	5.00– 9.00
20	Franciscan	3.50– 5.00	5.00– 9.00
21	Golden State		5.00– 8.00
22	Herald		4.00– 6.00
23	Huntington	8.00–12.50	8.00–15.00
24	King George	4.00– 5.00	5.00– 8.00
25	LaSalle	5.00	6.00– 7.00

KEY NO.	HOTEL	SINGLE	DOUBLE
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27	Manx	5.50– 7.00	7.50– 9.50
28	Mark Hopkins	10.00–14.00	14.00–20.00
29	Maurice	5.00– 6.00	6.50– 8.00
30	Olympic		6.00–10.00
31	Oxford		6.00– 6.50
32	Pickwick	4.50– 5.50	6.00– 8.00
33	Plaza		7.00–10.00
34	Powell	3.50– 4.25	4.25– 6.50
35	Richelieu	4.00– 6.00	5.00– 9.00
36	Roosevelt	3.50– 5.00	4.50– 7.00
37	St. Francis	8.00–18.00	10.00–20.00
38	San Carlos		3.50– 5.00
39	Senate	4.00	5.00– 6.00
40	Senator	3.50– 3.75	4.00– 5.00
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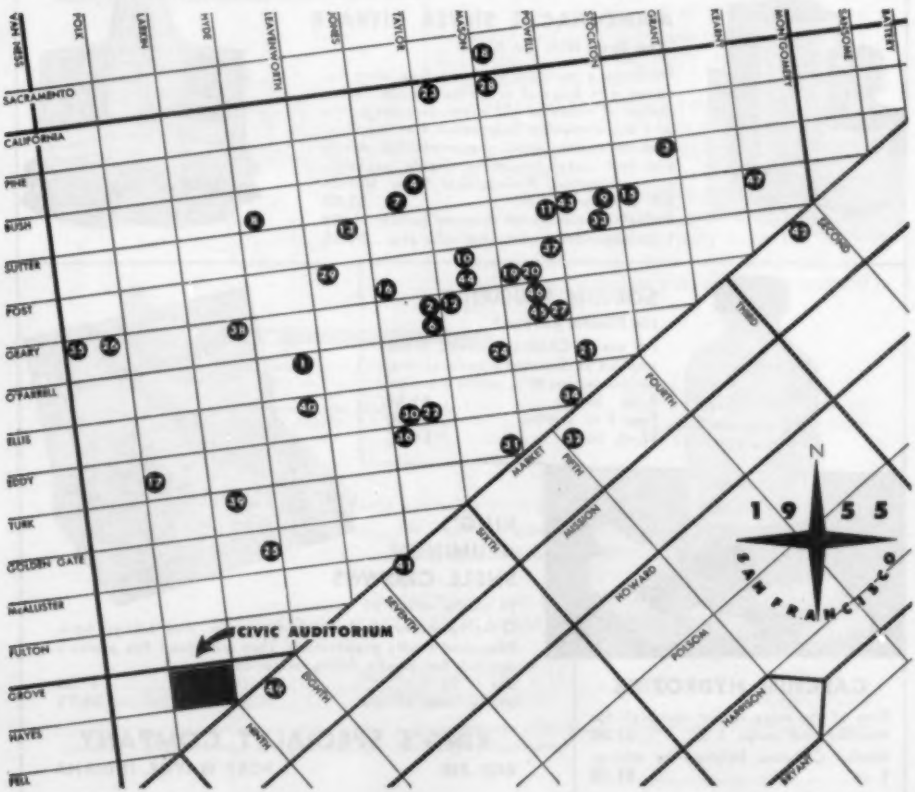
46	Stewart	4.50– 7.00	6.00–12.00
47	Sutter	4.00– 5.50	6.00– 9.00
49	Whitcomb	5.00– 9.00	7.00–12.00



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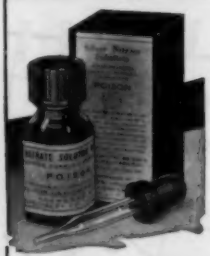

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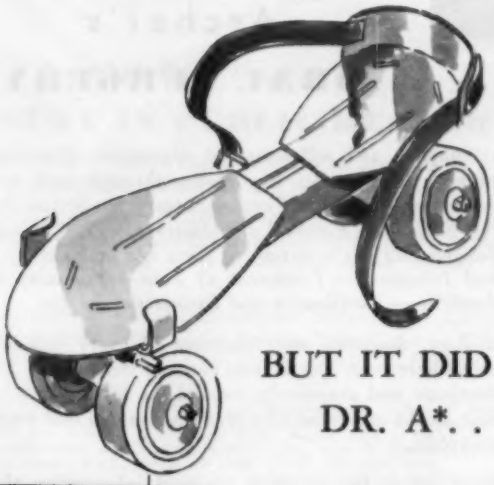

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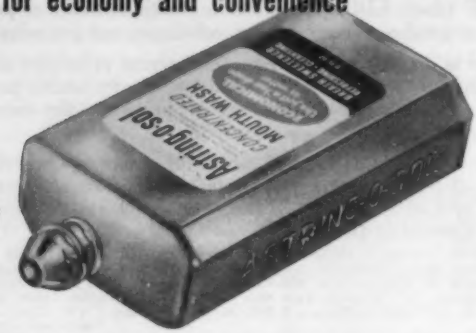

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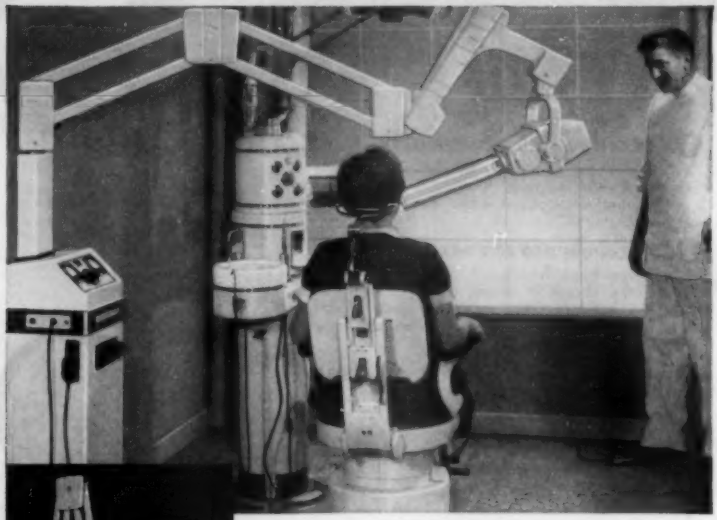

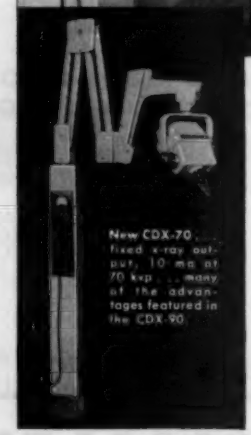

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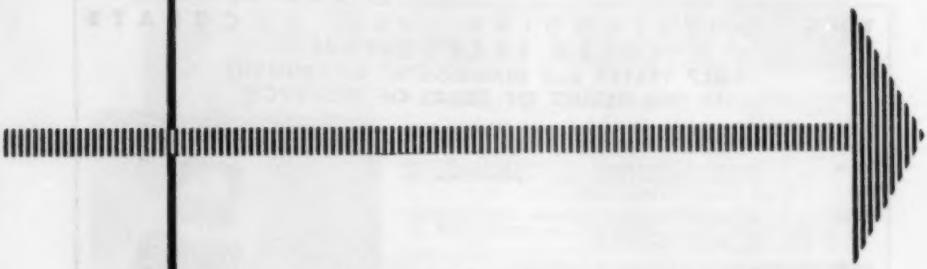

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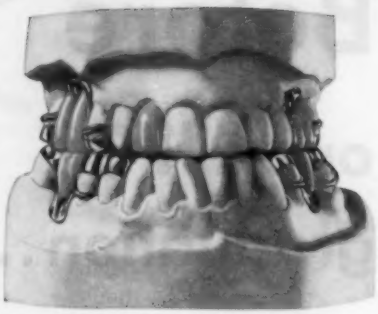

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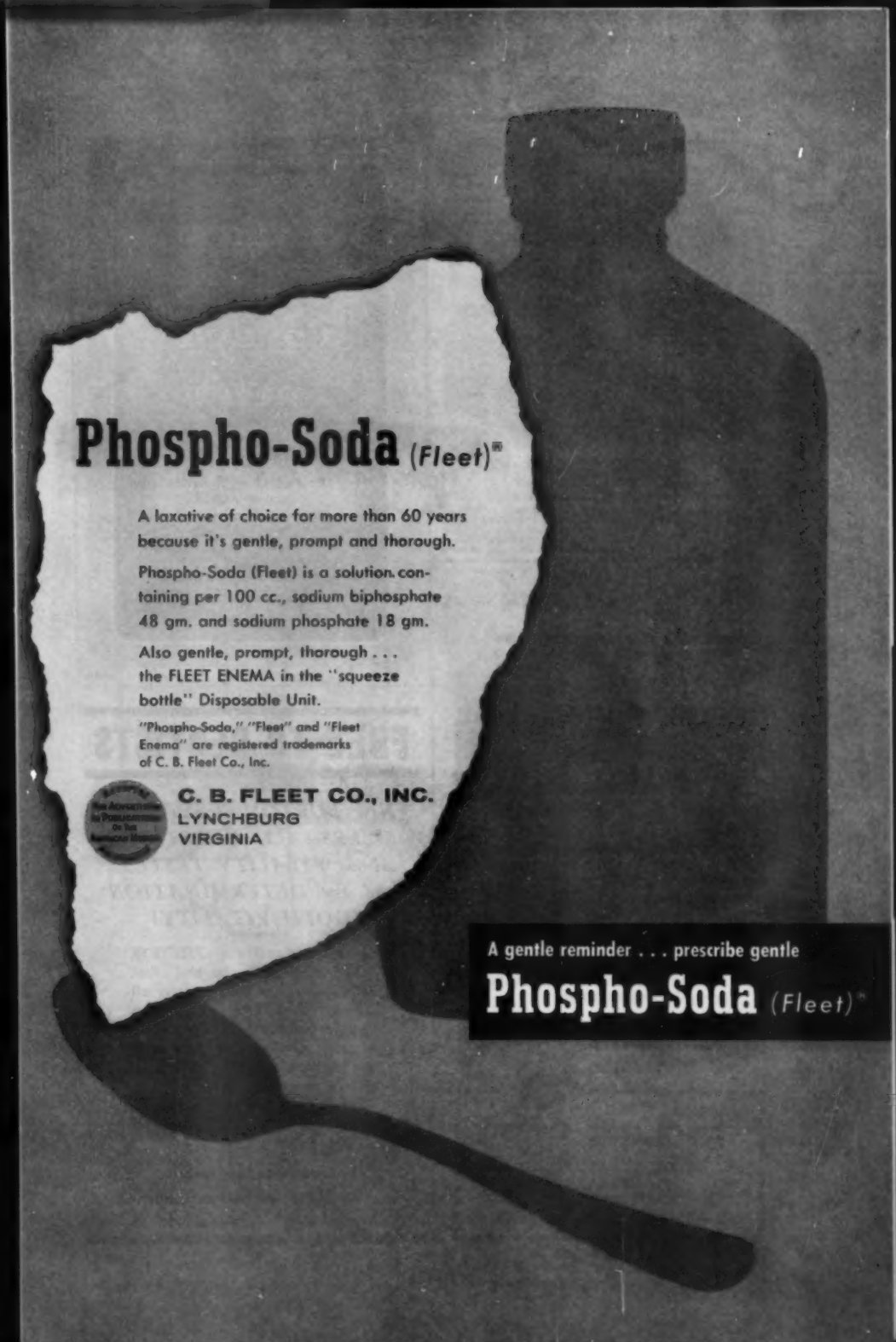
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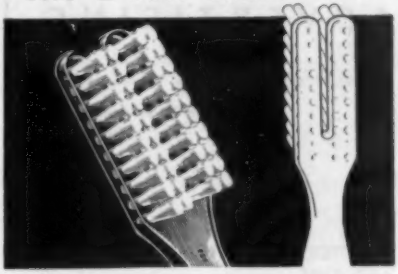

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CALIFORNIA—Dental suite, Hollywood Medical-Dental Bldg. Dentist joining service. Established practice. Nothing to sell. Location five years. Surgeries. Laboratory, dark room, recovery, office, common reception room. Dr. W. H. Enenstein, 3706 Sunset Blvd., Los Angeles 26, Calif.

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CALIFORNIA—For sale. Long-established practice in southern California. Owner retiring. Good location with beautiful view. High-class clientele. Six-month recall system. Terms to suit. Address A.D.A. Box No. 895.

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CONNECTICUT—For sale or rent. Attractive and well-equipped two-chair, five-room office, completely air-conditioned. Established since 1937. Located in industrial city of 20,000, ten miles from New Haven. Price reasonable. Going into service. Address A.D.A. Box No. 883.

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FLORIDA—For sale. Two-chair office in modern, centrally located office building in Miami. Completely air-conditioned. All modern Ritter equipment. Address A.D.A. Box No. 843.

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FLORIDA—For sale, ground-floor office in busy shopping center, Miami. Air-conditioned. Two operating rooms, dark room, laboratory, private office, reception room. Beautifully decorated. Will sell with or without equipment. Address A.D.A. Box No. 879.

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ILLINOIS—Completely equipped office, Ritter motor chair, Ritter model B unit, G.E. x-ray and S. S. White compressor. Will sell as going practice or equipment only. Moving out of state. Address A.D.A. Box No. 898.

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KANSAS—Dental practice, established 22 years. Heart of town location. Grossed as high as $38,000 in year, can do even better. Elderly doctor retiring, must sell because of health. Pay out in six months time. Information and free pictures mailed, no obligation. Write C-4088 Continental, 804 Grand, Kansas City, Mo.

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KANSAS—Sedan, county seat town. Excellent practice. Only two dentists in county. Large trade area extending into Oklahoma. Fully equipped one-chair office on ground floor. Reception room, x-ray, operating room, laboratory and dark room. Former dentist deceased. Write Mrs. W. O. Russell, Sedan, Kansas.

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MICHIGAN—Northwest Detroit. Building and practice for sale. Owner wishes to leave state. Building has two-chair dental suite, plus four-room suite as rental. Address A.D.A. Box No. 804.

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NEW YORK—Am retiring. Well equipped dental office for rent on my property. Air-conditioned. Ritter electric chair, S. S. White new unit, Weber wall type x-ray machine. Active practice. Lots of parking space. Excellent neighborhood. Fast growing city. Write Dr. H. M. Roblin, 2225 James St., Syracuse 6, N. Y.

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WASHINGTON—For sale. Long established and well equipped office in growing community of Puget Sound. Owner desires to retire. Address A.D.A. Box No. 882.

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WISCONSIN—For sale. Established practice of recently deceased dentist. Modern two-chair, ground floor, air-conditioned office. Fully equipped laboratory and x-ray. Excellent business town of 2,000. Mrs. John A. Smith, Durand, Wis.

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ILLINOIS—Dental office for rent in modern medical building. Two or three rooms plus reception room shared with physician. Excellent opportunity. Peoria area. Address A.D.A. Box No. 844.

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MASSACHUSETTS—Now available for rent, a front office suite in a new building ideally suited for a dentist and located in lovely college town of Amherst. Address A.D.A. Box No. 863.

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NEW YORK—Opportunity oral surgeon in well-located medical building. Unopposed. Offices to specifications. Reasonable rental. Occupancy September 1955. Dr. David Lang, 101 Hillside Ave., Williston Park L. I., N. Y. Phone Pioneer 2-3644.

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NEW YORK—For rent, office space formerly occupied by dentist. Private or common reception room with general practitioner. Good location. Write H. J. Sliski, M.D., 1040 W. Genesee St., Syracuse, N. Y., or phone 3-7755.

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PENNSYLVANIA—Internist in suburban area of Philadelphia has additional office space for rent suitable for a dentist. Available in July 1955. Address A.D.A. Box No. 885.

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TEXAS—Space available for orthodontist and pedodontist in pediatric center, southeast Texas. City is highly industrialized with 80,000 population. Excellent opportunity since there is need for well-trained specialists. Address A.D.A. Box No. 842.

OPPORTUNITIES AVAILABLE

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CALIFORNIA—Wanted dentist, California licensed. Community of 14,000 interior California. Air-conditioned office available in new professional building. Practice assured. Financial help available to start. Area needs dentist. Should net $12,000 to $20,000 first year. Friendly town, superb schools, good year-round climate. Wealthy area with diversified interests including agriculture and oil. Address A.D.A. Box No. 884.

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CANADA—Dentist needed to work in a rural children's preventive dental program in southern Saskatchewan. Involves some travel. Allowance for private car or government car supplied. Equipment and assistant provided. Salary to be negotiated. Apply to Children's Preventive Dental Program, Health Region No. 2, Assiniboia, Saskatchewan, Canada.

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MARYLAND—Dentists. Immediate vacancies at Eastern Shore State Hospital near Cambridge, Md. and Springfield State Hospital near Sykesville, Md. Salary scale: $5,273-$6,323. Contact the Commissioner of Personnel, 31 Light St., Baltimore 2, Md., by April 23, 1955.

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NORTH DAKOTA—Growing county seat town, with a population of 1,300, in east central North Dakota, wants a dentist. Our only dentist has transferred. Wonderful opportunity. Address A.D.A. Box No. 887.

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SOUTHEAST—Dentist, eligible for Florida license to associate with medical group practice in lovely resort town of 5,000 population. Also excellent opportunity for association in one of the south's fastest growing large cities. Write Mrs. Stewart R. Roberts, Medical Placement Service, 15 Peachtree Place, N. W., Atlanta, Ga.

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SOUTHEAST—Licensed hygienist for general practitioner in large southern city. Salary on a percentage basis averaging between $400 and $500 per month. Write Mrs. Stewart R. Roberts, Medical Placement Service, 15 Peachtree Place, N. W., Atlanta, Ga.

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Dentist, returning from naval service, available July, desires position with general practitioner, up-state New York. 1953 graduate N.Y.U. Write Lt. (jg) Rodman Brokaw, Sgt. Jasper Apts. 8F, Charleston, S. C.

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Dentist, licensed Pennsylvania and New Jersey, age 43, desires part-time or full-time association in a busy practice. Specialized in prosthetics for several years and in general dentistry for 19 years. Address A.D.A. Box No. 878.

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Dentist, age 30, military free, desires to associate on a commission or salary basis. Two years' private general practice experience. Prefer Texas or California. Will take Boards. Address A.D.A. Box No. 880.

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Connecticut dentist, completing service tour in April, seven years of successful practice prior to entering service, desires to purchase or an association for the purpose of eventual purchase of practice. Address A.D.A. Box No. 845.

●

Experienced orthodontist desires purchase of active practice or good location or group association in Florida. Available July. Reply air mail. Lt. Col. John T. Schwartzbek, 6110th USAF Hospital, APO 1054, San Francisco, Calif.

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Dentist, National Board, Missouri and Kansas license, age 29, no military obligation. Private practice two years. Desires association with group or individual practicing general dentistry or full mouth reconstruction. Willing to take Boards. Address A.D.A. Box No. 893.

Dentist wishes to act as liaison man for dental or medical-dental company. Full résumé of background, etc., will be given in first letter, detailing excluded. Address A.D.A. Box No. 894.

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Dentist, age 26, married, 1953 Emory University graduate, licensed in North Carolina and Georgia, completing service, desires location or association, preferably in central North Carolina. Address A.D.A. Box No. 889.

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Dentist, veteran, draft exempt, 1955 graduate, desires association or partnership to practice in Oregon. Address A.D.A. Box No. 898.

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Orthodontist, 31, California licensed, with university training and five years' experience, desires promising location or purchase of orthodontic practice in desirable California community. Address A.D.A. Box No. 890.

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Florida licensed dentist, 3 years' experience, age 31, wishes to purchase active practice, or would consider association, location or partnership. Military service completed. Address A.D.A. Box No. 899.

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Complete equipment operating room, Weber x-ray, S. S. White unit, pedestal type, Ritter pump chair, American cabinet, non-glare operating light, waste receiver, all finished in jade green. Laboratory—Quincy large size compressor, Baldor lathe, developing tank, dark room light, Perfection casting machine, accessories. Must be sold on or before May 1st. Retiring. Pick your own desired location. Dr. L. D. Head, Grand Ridge, Ill. Telephone 6961.

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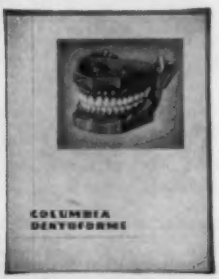

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Luxene 44 denture material was developed by Bakelite Corporation in collaboration with Carbide and Carbon Chemicals Corporation and Luxene, Inc.

Luxene 44 is not an acrylic resin. It is a vinyl co-polymer mixture plasticized with methyl methacrylate monomer and it possesses a combination of essential properties that have raised the standard of denture material values near the goal of perfection. It has been "built" by the world's foremost resin chemists specifically for dentures and it has no other commercial value.

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To safeguard against this possibility, a precision technic has been developed which is known as the "Pressure Cast" process, and details of this process are covered in the following pages. Selected laboratories, which are competent and reliable, are equipped and trained to use the "Pressure Cast" process and they are capable of producing restorations in Luxene 44 to a standard of perfection, the highest anywhere known.

When Luxene-vinyl teeth are selected for use with Luxene 44 denture material, an even more serviceable and practical denture results because Luxene teeth do not crack or craze. The teeth are exceedingly tough and very rarely break, even if the denture is dropped on a tile floor. Luxene teeth also have superior wear resistance, extensive clinical tests over a period of several years has established this fact. The illustration used here is known as the All Luxene C-Tone denture. The C-Tone effect is created by laminating thin sheets of Luxene 44 with proper concentration of blue and red fibres. Oral pathologists say this effect simulates nature.

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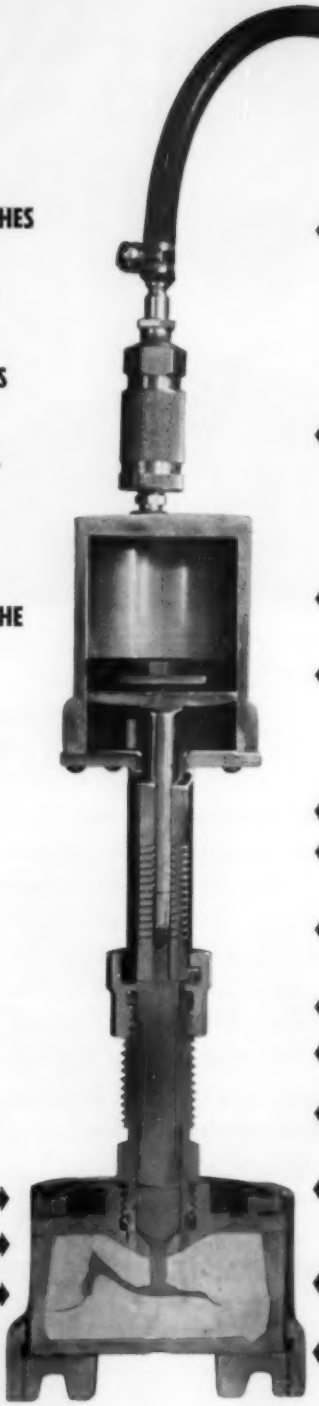

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Air gun adapter.

Piston.

Nozzle threaded to screw into air g adapter.

Lid and bottom surface perfectly flat so as to close uniformly.

Sprue button.

Side of cage.

Flask splits here. Notice how perfectly closed — metal to metal contact.

In the center of the flask is a cross-sectio of the moulded denture having no fi

Bottom ring of the "cage" which, whe tightened in cage closer, closes the fla perfectly.

Take your choice of the 3 alloys

AUTOMATICALLY GEARED

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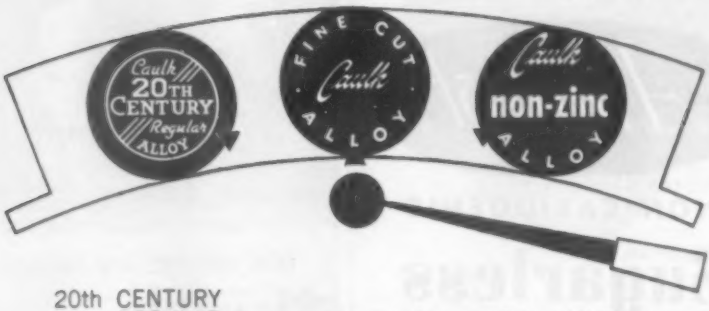

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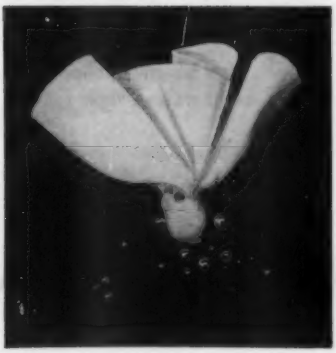

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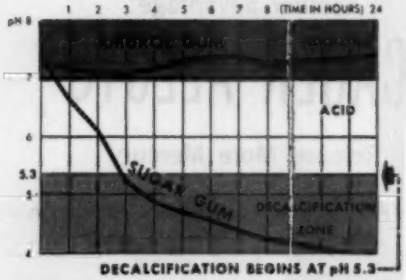
Comparative Effects of Sugar Gum and Amurol Gum on pH of Saliva



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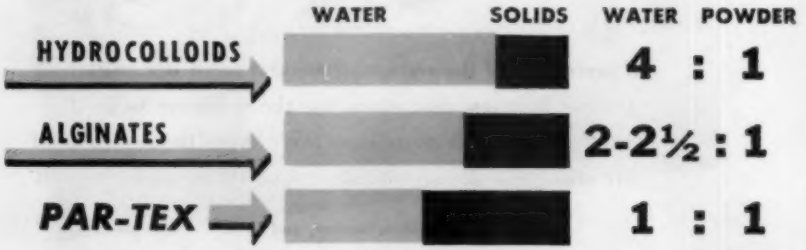

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rapid induction—rapid recovery
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You add to your good reputation with every GOLD case. Patients are sold on GOLD, sold on you.

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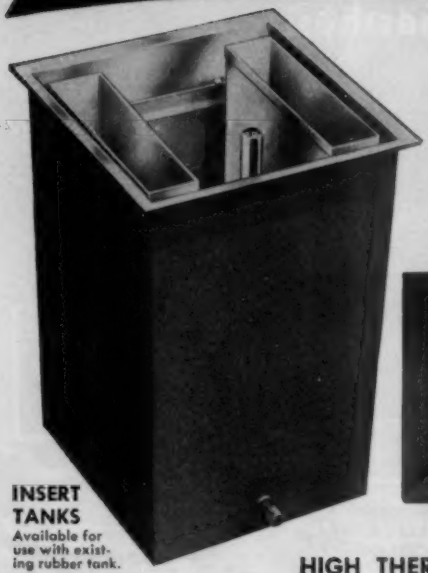

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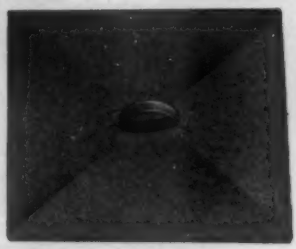

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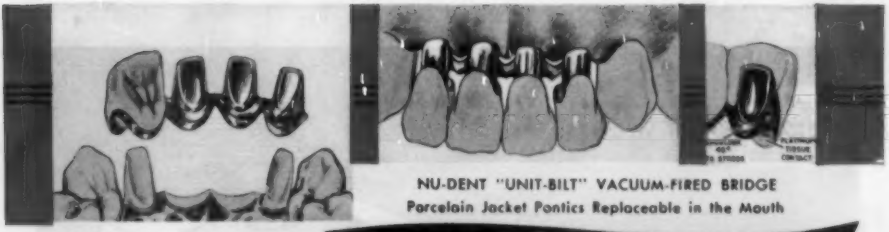

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Invisible cast gold base; platinum tissue contacts; strong, beautiful, vacuum-fired pontics.

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NU-DENT Vacuum-Fired Porcelain Restorations, when introduced 5 years ago, were a proven product — backed by years of research and clinical testing and their superior physical properties attested by a Recognized Testing Laboratory.

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***1—Nu-Dent Vacuum-Fired Porcelain is so hard and dense, so free from pits, pores and bubbles that, if ground, it can be repolished to a high glaze with fine pumice and a felt wheel.**

***2—Nu-Dent Vacuum-Fired Porcelain is very strong.**

3—Nu-Dent Vacuum-Fired Porcelain is vibrantly brilliant and translucent.

4—Nu-Dent Vacuum-Fired Porcelain Restorations will Match Any Specified Shade.

Two factors make these claims possible —

1—Nu-Dent's Original Technique of Firing in a High Vacuum (635 mm. or 25 in. mercury) in Nu-Dent's Patented High Vacuum Furnaces.

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***TESTING LABORATORY REPORT ON NU-DENT VACUUM-FIRED PORCELAIN**

Nu-Dent Vacuum-Fired Porcelain, compared to conventionally fired porcelain is —

48.8% Stronger
(Impact Test)
29.2% Stronger
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2.25% Harder; .64% Denser
Full Report on request.

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If considering other "Vacuum-Fired" Porcelain Restorations, insist on getting —

1—A Testing Laboratory Report on their Strength, Hardness and Density.

2—The degree of vacuum in which fired.

3—A Guarantee to match the shade you specify.

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➡ *Short-acting* NEMBUTAL *can produce any desired degree of cerebral depression—from mild sedation to deep hypnosis.*

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➡ *Hence, there's less drug to be inactivated, shorter duration of effect, wide margin of safety and little tendency toward morning-after hangover.*

➡ *In equal oral doses, no other barbiturate combines quicker, briefer, more profound effect.* Abbott

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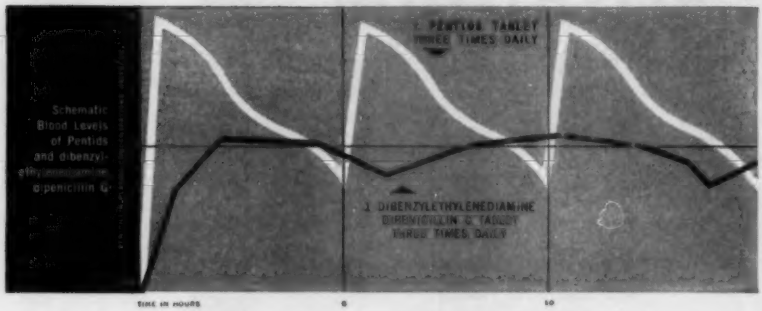
NEW YORK CHICAGO

*By Austenal Laboratories, Inc.

just **1** or **2** Pentids Tablets three times daily

as adjunctive therapy

for the more common dental infections


Schematic Blood Levels of Pentids and dibenzylethylenediamine dipenicillin G
1 PENTIDS TABLET THREE TIMES DAILY
1 DIBENZYLETHYLENEDIAMINE DIPENICILLIN G TABLET THREE TIMES DAILY
TIME IN HOURS
0
10

Pentids are particularly effective as adjunctive therapy for acute oral Vincent's disease, pericoronitis, alveolitis, dento-alveolar abscess, cellulitis, and osteomyelitis. Also for prophylaxis before and after extraction and other dental surgery.

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PENTIDS

(Squibb 200,000 Units Penicillin G Potassium)

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Supply:

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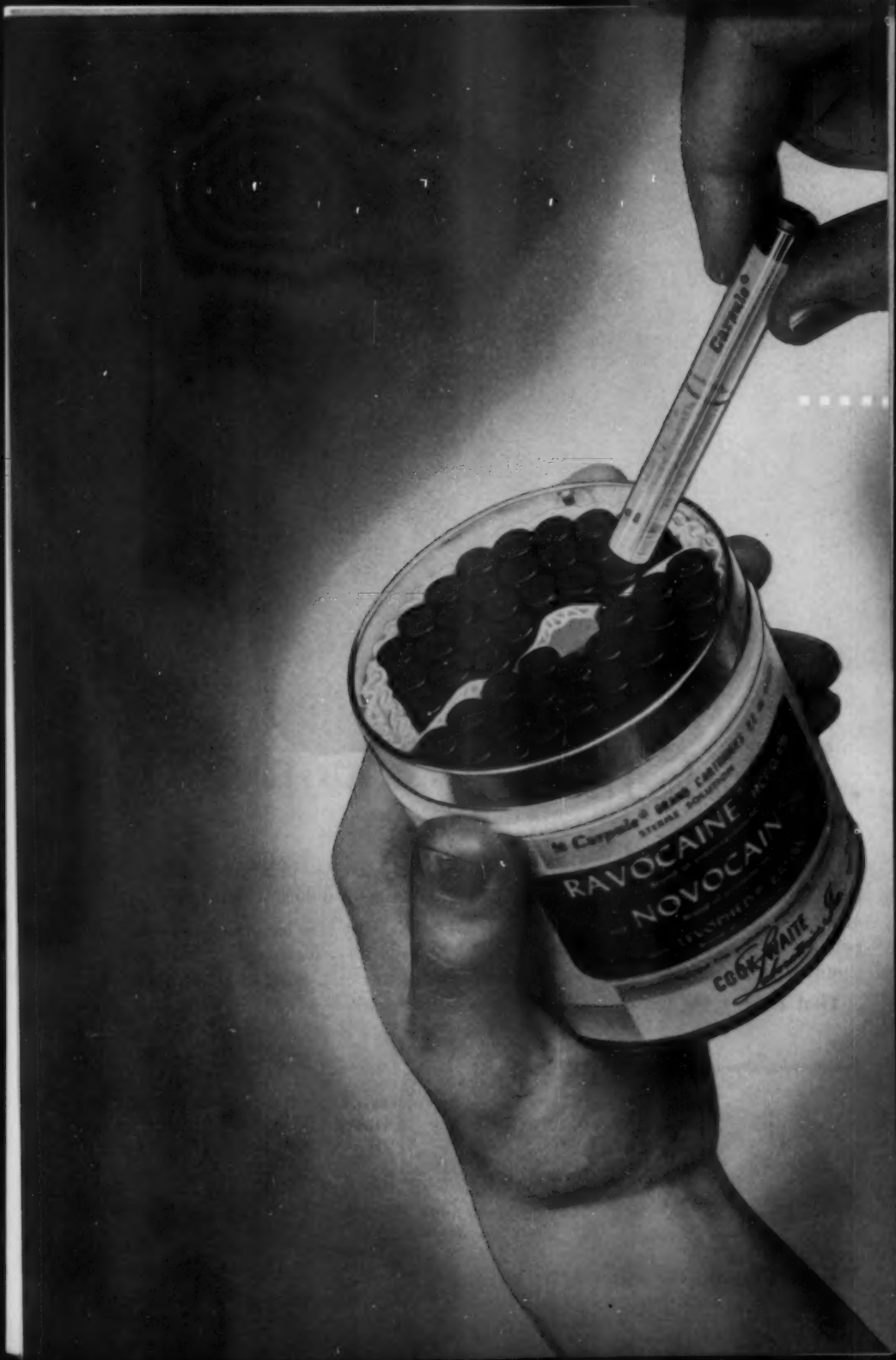
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New PLASTO-PIX have a carefully designed working point with surfaces which exert a gentle and cleansing polishing action.

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It has been estimated that it would require 244,000,000 fillings to restore the Dental Health of America's children between 6 and 18. In addition, it would require 33,000,000 fillings every year to keep up with the new cavities. Equally impressive is the fact that our large and expanding youngster population is expected to continue to increase for years and years to come. Here then is a vast market for your services which is practically untouched and which offers exciting opportunities for the future.

Previously comparatively little work was done with primary teeth, because conventional materials made care difficult and unprofitable. Now with Rocky Mountain's Tru-Form Primary Crowns you can successfully restore badly decayed children's teeth in one sitting at a great saving to you and your patient.

TRU-FORM PRIMARY CROWNS are only 30 cents each, introductory assortment of 100, $30.00. Of course, like anything fine in the profession, they require definite operating techniques. For instance: You choose a crown that seems a little small and bell it around the occlusal with RM Posterior Crown Stretcher, so it will fit over the occlusal, Fig. 1. Next, to get the tight "snap fit" around the gingival, you crimp around the gingival with a 112 plier, (Fig. 2) and then finish with a 114 plier, (Fig. 3).

Fig. 1

Fig. 2

Fig 3

You will find the new materials help promote satisfaction and respect and are great practice builders, because the *child of today is your patient of tomorrow.*

For more detailed information contact your dealer or check Technique Literature desired and mail coupon.

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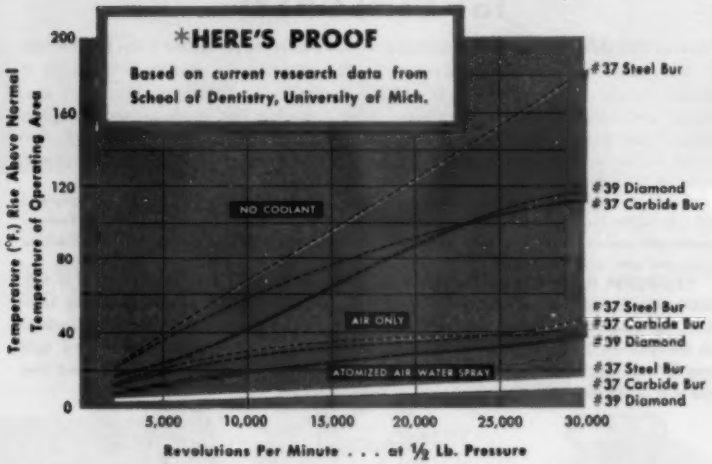
even at cutting speeds of 30,000 rpm



EXAMPLE: At intermittent operation of 2 seconds cutting and 1 second rest, without coolant, a #37 steel bur at ½ lb. pressure and 15,000 rpm increases the temperature 98° F. in 10 seconds. Accepting 98.6° F. as normal temperature of operating area, temperature of tooth is increased to 196.6° F. by the cutting operation.

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Achievements in dental research that will help you to save time and improve results!

these new GETZ quality products were designed to give you

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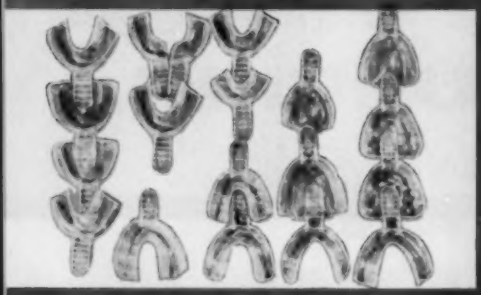

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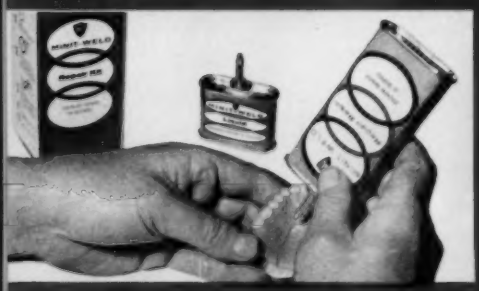
12 Standard Packages . . . $30.00	12 Economy Packages . . . $50.00



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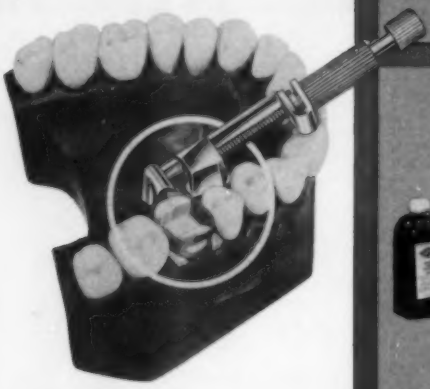

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Provides uniformly adapted trays or base plates in minutes. Positively stable and inert—will not change form during curing. Molds as easily and quickly as modeling clay.

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Provides permanent form-stability and dependable accuracy for inlays, crowns and bridges. Flexible—unhampered by undercuts. Saves labor. Provides better results. Non-sticky. No odor.

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Quantity	Item	Extension
	TOFFLEMIRE JR. CONTRA-ANGLE RETAINER @$15.00	
	SANI-TRAY Set No. 1, for partials (9 trays) @$2.25	
	SANI-TRAY Set No. 2, for dentures (10 trays) @$2.50	
	MINIT-WELD REPAIR KIT (complete) @$2.85	
	TRUPLASTIC IMPRESSION PASTE (see inside for special quantity values) Standard Package (12-15 impressions) @$3.00 Economy Package (25-30 impressions) @$5.00	
	KADEX STERILIZER OIL Quart @$3.75	
	ORYL DENTURE LINING MATERIAL Duo-Kit @$7.50	
	ONTRAY TRAY AND BASE PLATE PLASTIC KIT @$4.25	
	FORM-FLEX "Rubber Base" FLEXIBLE IMPRESSION MATERIAL Standard Package @$5.50	

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ARTHRITIC DENTAL PATIENTS NEED SPECIAL ATTENTION

Dental patients who have arthritis merit this attention because arthritics who take aspirin are actually 3 to 9 times more susceptible to stomach upsets than the general population.

Recent reports,[1, 2] have indicated that 27% to 42% of arthritics suffer nausea, dyspepsia or anorexia when they take aspirin. Yet 70% of those with proved intolerance to aspirin experienced no unpleasant after-effects with BUFFERIN, even in heavy doses.

BUFFERIN, therefore, is the analgesic of choice. It is far better tolerated than aspirin. It is faster acting—the salicylate is absorbed *twice* as fast as aspirin.

All of your patients will appreciate the routine use of BUFFERIN *before* operative procedures are undertaken as well as for postoperative comfort.

BUFFERIN® contains acetylsalicylic acid (5 gr. per tablet), for prompt analgesia, plus magnesium carbonate and aluminum glycinate. *Available* in bottles of 12, 36, 60 and 100 tablets.

References: 1. Report in press. 2. Brit. M. J. 1:1223 (May 29) 1954.

BUFFERIN® **Acts Twice as Fast as Aspirin**
Does Not Upset the Stomach

BRISTOL-MYERS PRODUCTS DIVISION

BRISTOL-MYERS CO., 19 W. 50 St., New York 20, N. Y.

B *stands for Beauty*

beau-ty (bū′tĭ), *n.* [*pl.* -ties (-tĭz)], [<*M.E. beaute* < O.F. *bealte* < Lat. *bellus,* pretty], 1, that combination of qualities which is pleasing to the eye or ear, or is satisfying to the æsthetic sense in the field of morals; 2, a particular grace or charm; 3, a beautiful person or thing; especially, a lovely woman.

B *also stands for* Bioform®

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